The AUTOMOBILE and Automotive Industries

Vol. XXXVII No. 9 NEW YORK, AUGUST 30, 1917 Ten cents a copy Three dollars a year

Editorial Contents, page 3 Advertisers' Index—Next to last page

You Can Take Hills on High Without A Knock

If you will keep your motor free from carbon. That knocking in your engine—the difficulty you have climbing hills—poor pick-up—lack of power—noisy motor—pre-ignition—in fact, 80% engine trouble is caused by carbon. Clean it out with

JOHNSON'S CARBON REMOVER

and your engine will run like it did the first 500 miles—quietly and full of "pep", and your gasoline consumption will drop from 12 to 25%.

You Can Do It Yourself

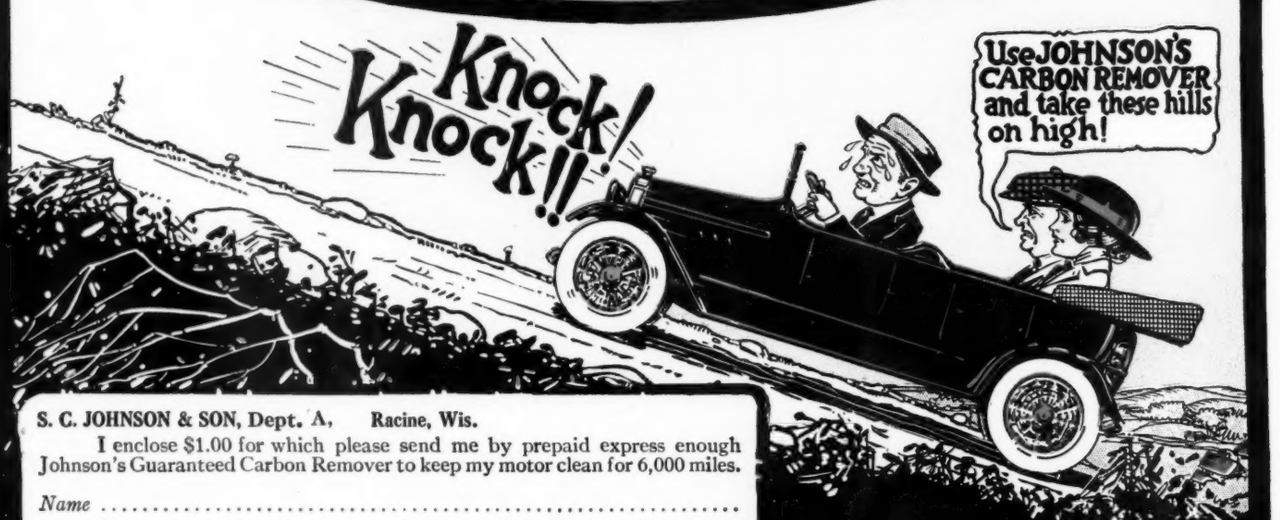
For 25c—five minutes time—and with no labor you, yourself, can remove all carbon deposits. Simply pour an ounce of Johnson's Guaranteed Carbon Remover into each cylinder—allow it to remain from 2 to 12 hours and then drive your car 10 or 15 miles. You will be surprised at the wonderful improvement.

Use It Every 1,000 Miles

If you will use Johnson's Carbon Remover at regular intervals, giving carbon no chance to accumulate, you will automatically eliminate most valve trouble and your engine will always be at its highest efficiency.
Write for our folder on Keeping Your Car Young—it's free.

If Your Dealer Cannot Supply You With Johnson's Carbon Remover—Use Attached Coupon.

S. C. JOHNSON & SON, A, Racine, Wis.



S. C. JOHNSON & SON, Dept. A, Racine, Wis.

I enclose $1.00 for which please send me by prepaid express enough Johnson's Guaranteed Carbon Remover to keep my motor clean for 6,000 miles.

Name .....

Address .....

City and State .....

My Dealer is .....

(A)

Made and Guaranteed by
S.C.JOHNSON & SON
Racine, Wisconsin, U.S.A.

The AUTOMOBILE and Automotive Industries

VOL. XXXVII NEW YORK—THURSDAY, AUGUST 30, 1917—CHICAGO No. 9

Weight Distribution in Passenger Cars

An Analysis as to the Proportion of the Total Road Weight of a Car Constituted by Each of Its Major Parts

By P. M. Heldt

AN important object which every designer of passenger cars constantly holds in view is to keep down the over-all weight. In these days of high fuel prices and increasing tire cost, any surplus weight is especially objectionable. But the gross weight of a car is made up of a large number of items representing the weight of its components. Each of these—at least so far as the more important parts are concerned—constitutes a nearly fixed proportion or percentage of the whole weight. Thus, by determining the percentage of the weight of a certain part as compared with the road weight of the car, with supply tanks filled, and comparing it with the corresponding figure for several other cars, we can form an idea as to whether the particular part is relatively light or heavy. To obtain such a basis of comparison the writer has gathered data on the weights of components for nearly a score of modern cars, calculated the percentage of the weight of each part in terms of the car road weight and averaged the percentages for each part.

For the weight of the complete cars I have taken those of five-passenger open touring models wherever possible, but in a few instances the larger cars are made only in seven-passenger models, in which case the weights of these were taken. The road weight of five-passenger touring cars begins substantially at one ton and the heaviest open cars weigh a little over two tons. In the accompanying diagram the variation of car weight with piston displacement is graphically shown. As the biggest engines have about three times the piston displacement of the smallest engines, while the heaviest cars weigh only twice as much as the lightest and the passenger load is the same, or only about 40 per cent more, it follows that the "ability" of the cars with the large engines is by far greater than that of the cars with the small engines.

Weight of Car Parts

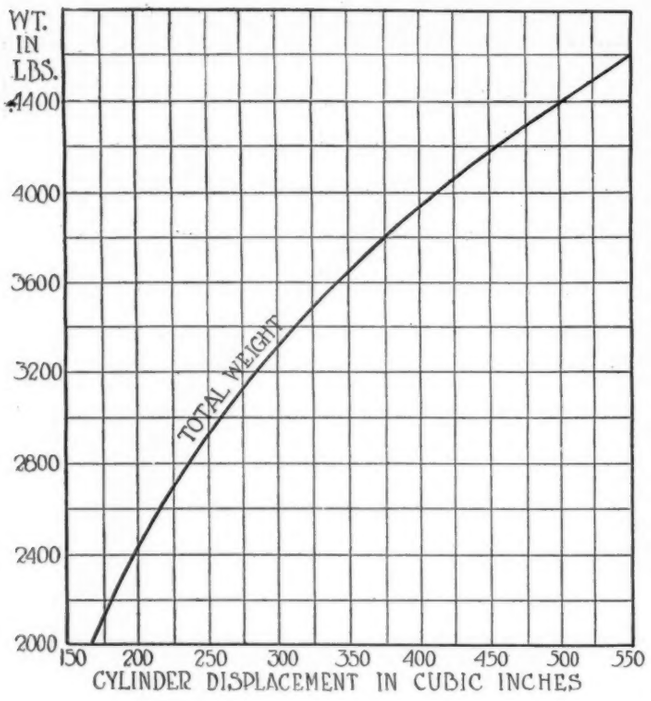
Based on Road Weight, Including Supplies.

Part	%
Frame	6.00
Springs	6.00
Front axle assembly	2.00
Steering gear	1.40
Radiator	1.80
Engine*	20.00
Clutch	0.90
Transmission	3.50
Front wheels	4.25
Rear wheels	5.25
Rear axle	7.50
Propeller shaft	1.10
Control assembly	1.10
Battery and box	1.90
Gasoline tank	0.80
Muffler	0.75
Lamps, switches, etc.	0.65
Hood	0.95
Starter and generator	1.65
Fenders	2.00
Running boards	1.00
Body, cushions	16.00
Top, side curtains	2.30
Windshield	1.00
Mudpan	0.45
Tools and box	1.10
Water	1.40
Fuel and oil	3.50
Parts not enumerated	3.75
Total	100

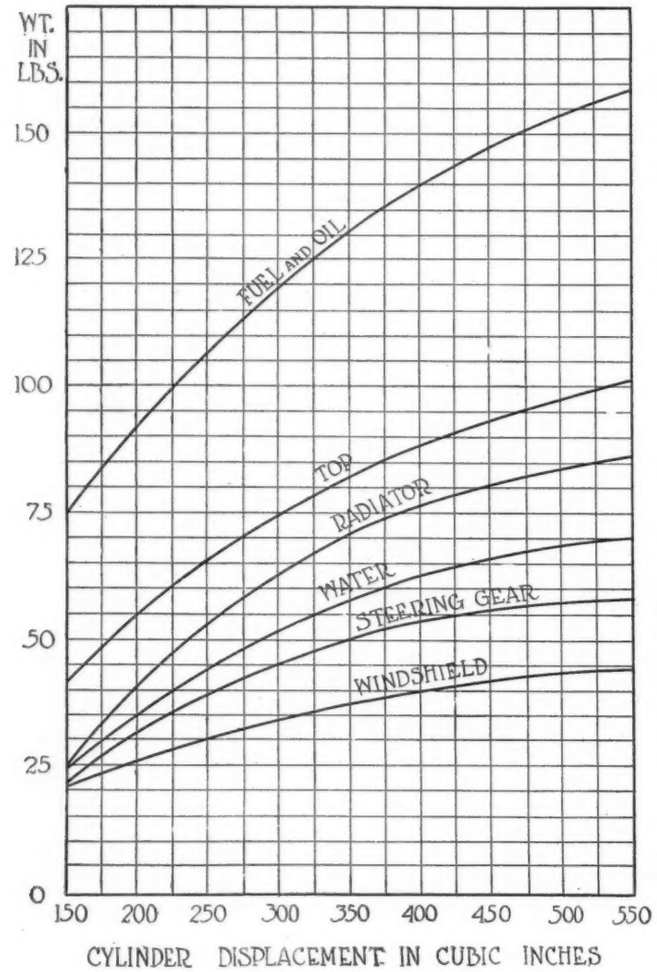
*With carbureter and manifolds.

Wide Variations

For some parts there is comparatively little variation in the percentage weight, while in others the variations are so great that a logical comparison is difficult. This latter remark applies particularly to the clutch. In some forms of clutches the flywheel forms the driving member of the clutch, and in that case only the driven member is weighed and may be very



Complete road weight of passenger cars



Average weight of passenger car parts as a function of the cylinder displacement

light. Other clutches comprise a separate driving member, and if, in addition, the average diameter of the friction surface is small, such clutches may weigh several times as much as clutches of equal capacity of the other type. Several of the extreme figures for clutches have been omitted from the table, as it was obvious that they represented unusual types. It will be seen from the table, page 354, that the average of the frame and the springs are substantially the same, both being a trifle over 6 per cent. In tabulating the frame weights one extra heavy frame which has a number of other parts formed integral with it, was omitted, as was a specially light frame made of wood sills. There is considerable variation in the proportional frame weights, which range from a little over 4 per cent to over 8 per cent. On the whole, the proportional weight is somewhat less in the smaller cars. When unit power plants are used few cross members are required, which tends to lighten the frame, and there are, of course, also great variations in the frame sections for cars of about equal weight. Manufacturers who build different models of closed bodies to go on the same chassis as their open bodies naturally chose to make the frame somewhat heavier.

Springs

There is less variation in the proportionate weight of springs than in that of frames. The springs serve a very definite purpose and there is little chance for cutting their weight, except by the use of high grade, expensive materials. Differences in the quality of materials would account for much larger variations in the weight of springs than that of frames, as the physical property which determines the weight of spring steel required is the elastic limit, which is nearly twice as high in the best grade of silicomanganese steel as in ordinary carbon steel, whereas the factor that largely determines the necessary weight of the frame is the modulus of elasticity, which is substantially the same for all grades of steel. Modern frames are made of as deep and heavy section as they are, not because if lighter there would be danger of the frame breaking, but because the sag or deflection under load would put undue strains on the body, causing it to creak and the doors to cramp.

Front Axle and Steering Gear

The front axle assembly, including the two knuckles and the tie rod, has an average proportional weight of slightly less than 2 per cent. As the design of all axles is substantially alike there should really be very little variation in this factor. However, upon the strength of the front axle the safety of the passengers is to quite an extent dependent, hence some designers consider it wise to figure with a very liberal factor of safety; in other cases, where a stock front axle is used, it happens that the exact size best suited to the conditions is not available and a somewhat heavier model has to be chosen. Closely related to the front axle is the steering gear, which in the average car weighs about two-thirds as much as the former. With few exceptions the weight of this part is closely proportional to that of the complete car.

There has been a material reduction in the weight of radiators in recent years, which is no doubt due to the popularization of certain types permitting of the use of very thin stock, having a minimum length of soldered joints and a maximum of direct radiating surface. Formerly, when the old-style cellular radiator was used on heavier cars, its weight often constituted as much as 3.50 per cent of the road weight of the car. With the modern types of radiator, for the most part built up

of crimped flat tubes made from sheet metal in special machines, the proportional weight has been nearly halved.

Engines and Clutches

Substantially one-fifth of the weight of the average car is constituted by the engine. With very few exceptions the variations from this ratio are small. Long strokes and the use of cast iron crank cases tend to increase the proportional weight, whereas high rotary speed tends to reduce it. Thus the car whose engine has the greatest proportional weight uses a cast-iron crankcase and the one whose engine has the next to the lowest proportional weight has a twelve-cylinder high-speed engine with aluminum crankcase.

As already pointed out, it is difficult to make a comparison of clutch weights, for the reason that several entirely different types of clutches are used, in some of which only one member is separate from adjacent parts and can be weighed. The great majority of clutches, however, are of the dry disk and cone types and there is no great difference in the weights of these types, though the disk type is the heavier of the two.

Differences in the proportional weights of transmission gearsets are due to the fact that some gearsets have a flange matching the engine bell housing, while others are without this flange; some of them have the control levers integral with them while others have not. However, those which have no supporting flange are provided with feet, which, while perhaps not as heavy as the flange, compensate for it partly at least. The figure of 3½ per cent found for the average proportional weight may be regarded as substantially correct for a three-speed gearset with cast-iron gear housing and with integral control lever set.

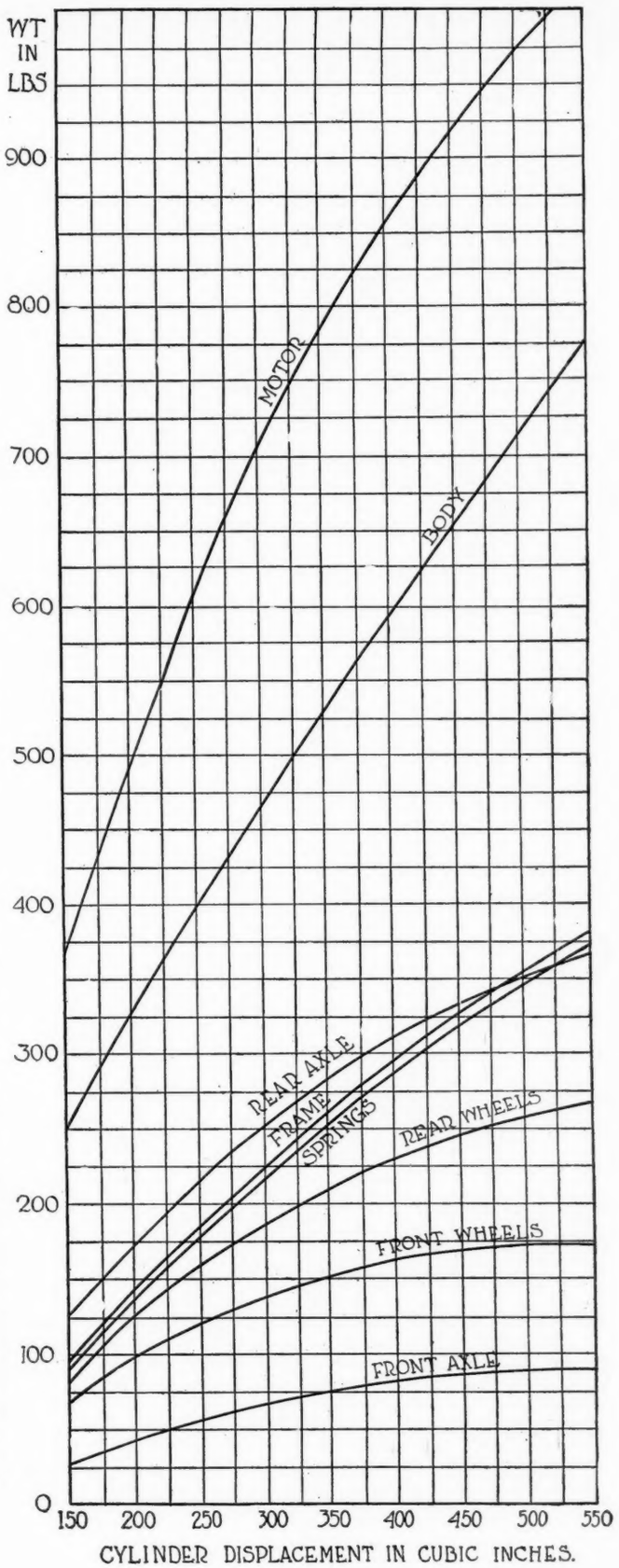
Wheels and Axles

Front wheels and rear wheels are generally almost identical except for some differences in the design of hubs and the fact that the rear wheels carry brake drums. These differences account for the approximately 20 per cent more weight in the rear wheels as compared with the front wheels. It may be pointed out that the actual and percentual weights of the wheels given refer to the weights of the sets of two wheels complete with rims and tires.

Aside from the engine the heaviest mechanical part of the car is the rear axle. It constitutes substantially 7½ per cent of the weight of the car when ready for the road. There has been some discussion as to what makes the lightest rear axle construction, the built-up type or the pressed steel type. Most people would pick the pressed steel type as the lightest, as cast housings cannot be made as thin-walled as pressed housings, besides which there is no overlapping of walls on the pressed steel housing, as there is in the built-up housings where the axle tubes enter the hubs of the driving gear housing. On the other hand, the pressed steel housing is always made of low carbon steel with an elastic limit of only about 35,000 lb. of sq. in., whereas in a built-up housing medium carbon, nickel steel tubes of more than twice this elastic limit can be used. However, while this high-grade material is available it is not always used and as a matter of fact the axle of the greatest proportional weight listed is of the built-up type.

Miscellaneous Parts

Little needs to be said with regard to the items propeller shaft and control. The former was intended to include the universal joints. There is a question whether this was understood in every case by those who supplied



Average weight of the heavier component parts of passenger cars plotted against the piston displacement of the engine. Note that practically all curves are concave to the base line

Per Cent. Weights of Car Components

Cylinder Displ.	Frame	Springs	Front Axle	Steering Gear	Radiator	Motor	Clutch	Trans.	Front Wheels	Rear Axle	Rear Wheels	Propeller	Control	Battery and Box	Gas. Tank	Muffler	Lamps	Hood	Start and Gen.	Fend.	Running-Boards	Body	Top	Wind-shield	Mud Pan	Tools and Box	Water	Fuel and Oil
165	6.37	5.45	1.85	1.25	1.86	26.38	.68	....	5.16	....	5.64	.73	.68	2.19	1.65	.29	.39	1.07	2.29	2.24	1.02	20.42	2.09	1.36	.27	....	1.46	2.68
186	7.06	4.17	1.87	2.79	1.40	15.46	....	....	4.28	7.20	5.36	.59	.59	2.71	.69	.25	.42	.81	1.50	2.16	.70	19.40	3.07	1.28	.39	.78	1.30	2.87
224	4.18	5.88	2.51	1.09	1.40	19.70	1.09	3.10	4.68	7.18	5.88	1.55	....	2.27	.53	.79	1.32	1.13	2.27	2.79	....	13.62	2.00	.98	....	.75	.94	4.34
224	4.10	5.10	1.18	....	1.41	17.50	....	4.24	4.48	10.38	4.96	1.35	....	1.90	.71	....	.31	.78	1.83	1.45	....	....	....	.79	....	....	....	....
224	4.18	4.17	1.41	1.12	2.40	19.06	.70	3.82	4.29	7.00	4.62	.61	....	2.22	1.25	.55	.33	1.07	1.73	1.81	.68	11.62	2.15	.79	.59	.82	1.86	3.56
253	....	4.78	2.51	1.44	2.60	....	....	....	4.22	6.60	....	1.33	1.05	1.93	....	1.28	....	1.02	1.44	2.10	1.61	14.04	2.77	1.02	....	.53	1.58	3.16
249	4.47	6.45	2.41	1.26	1.76	24.48	.72	2.75	4.24	6.45	5.26	1.84	1.71	1.71	.99	.72	.27	1.26	1.71	2.65	.89	19.21	2.19	1.00	.31	.17	1.37	3.93
275	7.06	5.56	1.62	1.65	2.29	14.92	.89	3.88	4.13	5.78	5.46	....	1.21	1.21	....	.98	1.78	1.44	....	1.97	....	....	....	....	....	2.03	.83	....
283	7.92	6.73	2.61	1.54	1.24	20.10	.74	3.71	4.23	7.12	4.95	1.02	....	1.42	.62	.31	.31	1.02	1.24	1.67	1.05	20.70	2.32	.90	....	....	2.01	3.40
289	7.35	6.44	2.40	1.56	1.82	20.40	.92	2.43	3.18	8.62	3.69	2.15	.55	2.15	....	.55	....	1.20	1.81	2.22	.62	....	2.03	.77	.46	.83	1.11	3.27
299	6.32	7.56	2.38	1.54	1.75	22.60	.65	2.70	4.24	7.18	5.56	1.55	1.61	1.86	.90	.71	.31	1.26	1.46	2.53	.87	21.00	2.27	.92	.28	.25	1.27	3.72
325	5.90	7.43	1.84	1.87	2.40	20.54	1.26	3.97	5.65	7.32	6.50	.58	1.26	2.36	.79	1.23	1.15	.65	....	2.23	1.00	13.70	2.78	1.26	.18	1.37	1.30	3.46
338	7.75	6.51	1.49	1.53	1.40	18.42	....	4.55	....	7.26	....	1.07	.47	....	.80	.40	.64	.52	1.47	1.83	.75	13.84	2.45	1.05	....	1.92	1.33	3.80
395	7.42	6.42	2.16	1.73	....	21.22	1.05	3.14	4.36	8.36	6.24	.77	2.03	1.70	.56	1.30	.91	.68	....	1.69	1.35	14.38	2.00	1.12	.75	1.25	1.25	2.49
399	5.42	....	1.74	1.45	1.71	15.95	....	2.62	3.24	8.63	3.34	....	....	1.54	....	.26	.29	....	1.04	....	....	11.11	1.88	....	....	....	1.11	3.44
485	6.31	5.94	1.89	1.76	....	21.92	.53	3.42	3.85	7.40	5.73	.71	1.81	1.49	.52	1.28	.80	.69	....	1.49	1.26	16.50	1.77	1.03	.62	1.38	1.65	3.58
555	8.65	7.22	2.47	1.67	1.73	21.58	....	4.73	....	7.80	....	.85	.43	1.83	.73	.37	.58	.58	1.54	1.67	.78	13.49	2.51	.96	....	1.76	1.51	3.58
Aver.	6.67	6.06	1.97	1.39	1.80	19.65	9.63	3.53	4.28	7.40	5.22	1.10	1.12	1.90	.83	.72	.65	.95	1.64	2.03	.97	15.92	2.29	1.02	.43	1.07	1.37	3.44

the data, and the average proportional weight given may be a little low. Control also is somewhat indefinite. It was intended to refer to the gear and brake lever assembly, but in some cases this was included in the weight of the transmission, and the weight of the pedal assembly was given instead.

The battery and its box account on the average for 1.90 per cent of the whole car weight. There is no striking change in the proportional weight of this part with the size of the car, though it is a little greater in small than in large cars. Gasoline tanks vary remarkably in weight, very much more so than the quantities of gasoline carried, which indicates that some makers use much heavier stock in these tanks than others. Similarly, there is quite a variation in the proportional weights of mufflers, from 0.25 to 1.28 per cent. While it would be poor policy to sacrifice muffling efficiency for the sake of a little saving in weight, it would be well for those whose mufflers are among the heaviest to study the action and the construction of the relatively light mufflers.

The weight of the bonnet naturally will vary with the type of the engine and with the gage of sheet metal used, but the average weight is not far from 1 per cent of the total car weight. There is no need for commenting on the other small parts, but the body weights call for a word of comment. There are several styles of body construction and the proportional weight depends upon the type used. Sheet metal is being used more and more, and the application of the acetylene welding process permits of further reducing the weight by eliminating heavy joints and framework.

From the above it would seem that a normally proportioned car has its total road weight made up about as follows:

	P.C.		P.C.
Frame	6.00	Muffler	0.75
Springs	6.00	Lamps, switches, etc.	0.65
Front axle assembly	2.00	Hood	0.95
Steering gear	1.40	Starter and generator	1.65
Radiator	1.80	Fenders	2.00
Engine*	20.00	Running boards	1.00
Clutch	0.90	Body, cushions	16.00
Transmission	3.50	Top, side curtains	2.30
Front wheels	4.25	Windshield	1.00
Rear wheels	5.25	Mudpan	0.45
Rear axle	7.50	Tools and box	1.10
Propeller shaft	1.10	Water	1.40
Control assembly	1.10	Fuel and oil	3.50
Battery and box	1.90	Parts not enumerated	3.75
Gasoline tank	0.80		
		Total	100

*With carbureter and manifolds.

Glasses Protect Eyes from Injurious Radiations

WORKMEN engaged in certain operations, such as acetylene welding, are obliged to wear what are generally described as dark-colored glasses to protect their eyes from the intense light emitted by the white hot metal and the incandescent portion of the flame. An investigation of the different glasses used for such purposes has been made by W. W. Coblentz and W. B. Emerson of the Bureau of Standards and reported by them in Technologic Paper No. 93.

The object of the investigation was to determine the general characteristics of certain newly developed glasses sometimes used for protecting the eye from radiant energy, especially the infra-red or heat rays.

For protecting the eyes from ultra-violet rays, light, black, amber, green, greenish yellow and red glasses are efficient. Spectacles made of white crown glass afford some protection from the extreme ultra-violet rays which come from mercury in quartz lamps and from electric arcs between iron, copper, or carbon. The vapors from these arcs emit but little infra-red radiation in comparison with the amount emitted in the visible and in the ultra-violet.

For shielding the eye from infra-red rays deep-black, yellowish-green, sage-green, gold-plated, and bluish-green glasses are the most serviceable. For working near furnaces of molten iron or glass if considerable light is needed a light bluish-green or sage-green glass is efficient in obstructing the infra-red rays. For working molten quartz, operating oxy-acetylene or electric welding apparatus, searchlights, or other intense sources of light, it is important to wear the darkest glasses one can use, whether black, green (including gold-plated glasses), or yellowish-green, in order to obstruct not only the infra-red but also the visible and the ultra-violet rays.

Visible Rays Present No Problems

One can easily decide upon the kind of glasses to use to protect the eye from the visible rays. The question is not so easily settled concerning the elimination of the ultra-violet and the infra-red rays. The data presented in the Technologic Paper referred to give some clue as to what can be accomplished in eliminating the infra-red rays.

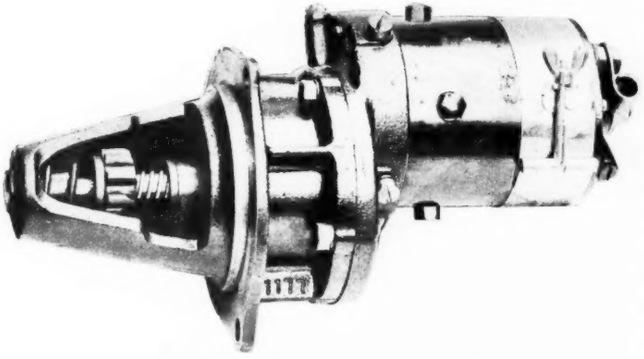
Data are given showing that of the infra-red rays emitted by a furnace heated to 1000 to 1100 deg. C (1) about 99 per cent are obstructed by gold-plated glasses, (2) about 95 per cent by sage-green or bluish-green glasses, (3) about 60 to 80 per cent by very deep-black glasses, and (4) about 60 per cent by greenish-yellow glasses.

New Bijur Screw-Shift Starter Gear

Obviates Possibility of Locking Due to Pinion Teeth Abutting Against the Gear Teeth

HERETOFORE the Bijur Motor Lighting Co. of Hoboken, N. J., manufacturer of two-unit starting and lighting systems, has been using a pedal-operated starter gear. Mr. Bijur, however, has been working along other lines, as was brought out recently by the issuance to him of a U. S. patent covering different types of starter drive. The Bijur company has worked out an entirely new design of the screw-shift gear which is claimed to make locking of the teeth an impossibility. This locking ordinarily occurs when, as the starter pinion travels along the threaded shaft toward the flywheel gear, a tooth of the pinion abuts squarely against a tooth of the gear ring. To prevent locking under these conditions the Bijur drive is provided with a longitudinally slidable pinion shaft and with a friction clutch, which permits of slippage between the intermediate gear and the shaft.

Referring to the sectional view of the drive, which shows the housing W to which the motor is bolted, which housing in



Starting motor with new Bijur drive

turn is mounted inside the flywheel housing, the motor armature shaft A has a pinion X cut upon its end, which pinion is always in mesh with the intermediate gear D. This gear is loosely mounted on the drive shaft B. Pressing against the face of intermediate gear D is a leather or thermoid clutch disk E, which is riveted to steel plate F. A light pressed steel shell S extends around the clutch to exclude dirt, oil and other foreign matter from it.

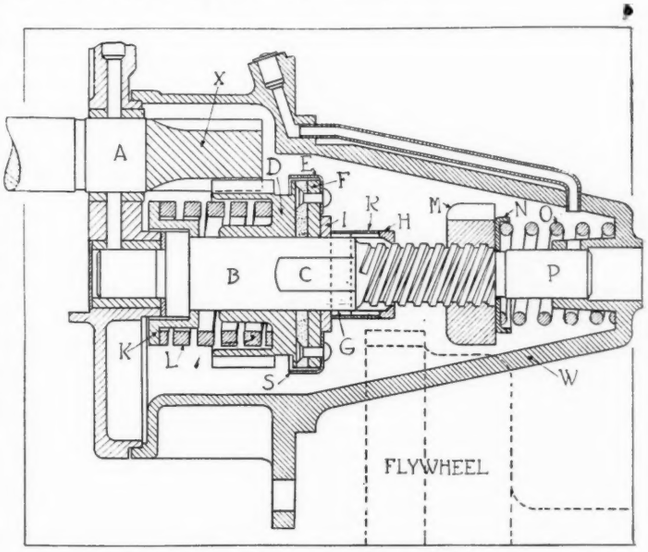
The whole clutch assembly, consisting of members E, F, S, I, R, G and H, can move horizontally on the drive shaft, but must rotate with it on account of the flats C which register with similar flats in the clutch plate F and the clutch facing E. Adjacent to clutch plate F is a sleeve H, cut with two slots through which extends a pin G. The spring cover R holds the pin in place. The function of pin G is to limit the horizontal travel of the clutch assembly on drive shaft B. The latter has a range of travel of 5/8 in. in the direction of its axis. Spring L, which is partly located inside the intermediate gear D, presses the face of gear D against the clutch facing E, and the pressure between these two members is sufficient to cause the gear to turn the clutch and shaft unless the shaft is held from turning. The pressure is not sufficient, however, to cause the clutch to transmit any great amount of power.

In operation, the closing of a single-contact switch connects the starting motor directly to the battery, and the motor begins to rotate. Intermediate gear D rotates drive shaft B through the clutch. Pinion M screws itself to the left, if the pinion teeth register with the tooth spaces of the flywheel gear. The pinion will then continue to travel into mesh until the entering face of the pinion comes in contact with sleeve H. As the pinion continues to travel toward the left, it pushes sleeve H, and with it the whole clutch assembly and intermediate gear D, in the same direction, and compresses spring L. When the shoulder of the intermediate gear D comes in contact with the shoulder on the shaft, the pinion is in full mesh with the flywheel gear.

With spring L tightly compressed there is sufficient pressure between the face of intermediate gear D and clutch member E to cause the clutch to transmit to the drive shaft the power required for cranking. The starter then spins the engine until the latter takes up its own cycle of operations. As soon as the engine begins to fire, the flywheel gear causes pinion M to rotate faster than shaft B is rotated by the starter. The pinion, however, travels to the right and out of mesh with the flywheel gear. On disengaging from the gear the pinion is cushioned by spring O.

The above describes the operation of the gear when the teeth of starting pinion M happen to register with the tooth spaces of the flywheel gear, so that meshing is not interfered with. If the pinion teeth happen to abut against the gear teeth as pinion and gear are about to engage, the action is as follows:

On closing the starting switch, pinion M travels to the left until its teeth abut against those of the flywheel gear. The pinion is then prevented from rotating, as the flywheel gear is standing still. But since the shaft is rotating and is capable of longitudinal motion it screws itself through the pinion, traveling to the right and carrying with it sleeve H, the clutch assembly, intermediate gear D and spring L. The driveshaft and the assembled parts on it move to the right until sleeve H engages pinion M. The pressure exerted between the pinion and the sleeve firmly clamps the pinion to the sleeve. The pinion teeth are pressed against the teeth of the flywheel gear by the comparatively light spring O; therefore, when sleeve H firmly grips pinion M it causes the pinion to rotate with it. After a small rotary movement of the pinion, its teeth register properly with the tooth spaces of the flywheel gear, and spring O snaps the drive shaft parts assembled thereon back to their original position. The pinion is then free to travel into full mesh with the flywheel and start the engine as previously described.



Bijur double-geared pinion shift

Standard Ammunition Body

Specifications Issued from War Department by Chief of Ordnance—All Steel Construction

QUALITY OF MATERIALS: Except it be otherwise specified, all materials are to be the best of their respective kinds, and all labor is to be done in the most thorough and workmanlike manner. In all cases where an article is mentioned in these specifications in connection with the words "best quality," "best make," "proper," or "suitable," the Ordnance Department or its authorized representative shall decide what is best and most suitable to use.

2. AWARD OF CONTRACT: The bodies herein specified are to be used in the field service of the Ordnance Department, and in the selection of bodies and award of contract, the quality of material, design, workmanship, and suitability for use in field service will be given due weight in determining which proposal shall be accepted. Attention is called to Instructions to bidders, form No. 434.

3. EMPLOYMENT OF CONVICT LABOR: In the performance of work herein specified, the contractor shall not, directly or indirectly, employ any person undergoing sentence of imprisonment at hard labor which may have been imposed by a Court of any State, Territory or Municipality having jurisdiction, nor permit such employment by any person furnishing labor or material to said contractor in fulfillment of this agreement.

4. PATENTS: The contractor shall for all time secure to the Government the free and undisputed right to use any and all patented articles used in the work, and shall defend at his own expense any and all suits for infringement of any patent or patents, and in case of adverse claims under patents, the contractor shall pay all awards.

Description

5. GENERAL REQUIREMENTS: The bodies shall be complete in every respect and ready for installation on the chassis transom frame. It is intended that these bodies shall be so constructed as to permit of their installation on any chassis frame irrespective of the width or height of frame, and at the same time permit of ready access to the transmission and rear axle, and to give a proper clearance between the rear wheels and truck body when the truck is fully loaded. The body shall be constructed in accordance with details shown on drawings, Nos. Cl. 31—Div. 20, Fig. 4.

6. MATERIAL: The entire body, sides, end and rear doors are to be made of No. 10 Flange Steel Commercial or best quality, No. 10, hot rolled, smooth finish, medium temper steel of 0.15 carbon.

7. All iron or steel used in construction of bodies must be free from rust, corrosion or pitting, and must not be bent or warped. Where steel castings are used they must be thoroughly annealed. The special body parts shown on the drawings, including fastening brackets of body to chassis, hinges and hinge butts must be made of forged steel.

8. The body shall be reinforced at proper intervals as shown on drawing with 3-in., 4-lb. standard steel channels thoroughly fastened to the body with hot 7/16-in. rivets. All holes in the body shall be 1/32 in. larger in diameter than rivets, and will be reamed after punching.

9. All parts of the body, where possible, must be connected by 7/16-in. hot rivets.

10. All steel floor plates, body side and top angles or channel, and all other steel strips or sections shall be in continuous lengths. No piecing of these parts will be permitted, except it is allowable to make body sides and bottom of two pieces welded along the center of bottom.

11. Brackets for securing various implements to body will be furnished by the United States and installed in such locations as shown by drawing and will conform to drawing, Nos. Class 31—Div. 20—drg. 4.

Covers

12. MATERIAL: The body covers must be best quality No. 6 standard cotton duck, made from American cotton, woven in a workmanlike manner and free from imperfections, thoroughly brushed to remove motes or other foreign substances, and must be waterproofed. No pieced lengths will be allowed.

13. The covers must have grommets worked over ⅝-in. galvanized iron rings. Ropes to be ⅜-in. of best quality Manila. All side ropes to be neatly spliced into grommets, all face ends to be well whipped with well waxed thread.

14. LETTERING: All covers must be stenciled in two places with "U. S." with 6-in. black Doric letters, and "ORD." and "DEPT." with 4-in. black Doric letters, the whole to be arranged symmetrically, as shown in drawing, 38—9—14.

15. GENERAL PROVISIONS: The covers must be made in accordance with the dimensions shown on drawings. All work to be done in the best workmanlike manner. Covers to be subject to the usual inspection.

16. PAINTING: The bodies must be painted all over, as per drawing 27—26—1 (prints of which specification will be sent on request), each coat of paint being permitted to thoroughly dry before applying the succeeding coat.

17. All iron and steel must be given one good coat of lead and oil, and permitted to thoroughly dry, before assembling.

Good Market for Small Tractors in Chile

THERE is a natural market for small tractors in the cereal regions of Chile, according to the Department of Commerce. It is believed that much progress will be made by traction plowing, and that gasoline tractors will take the place of the many portable steam engines that are now in use. At one time efforts were made to introduce steam tractors, but these did not meet with success, because it is generally recognized that steam tractors are too heavy for plowing purposes. Another difficulty is that wood is the most desirable for fuel, and operators have found it almost impossible to keep up the desired pressure where plowing could be made practicable.

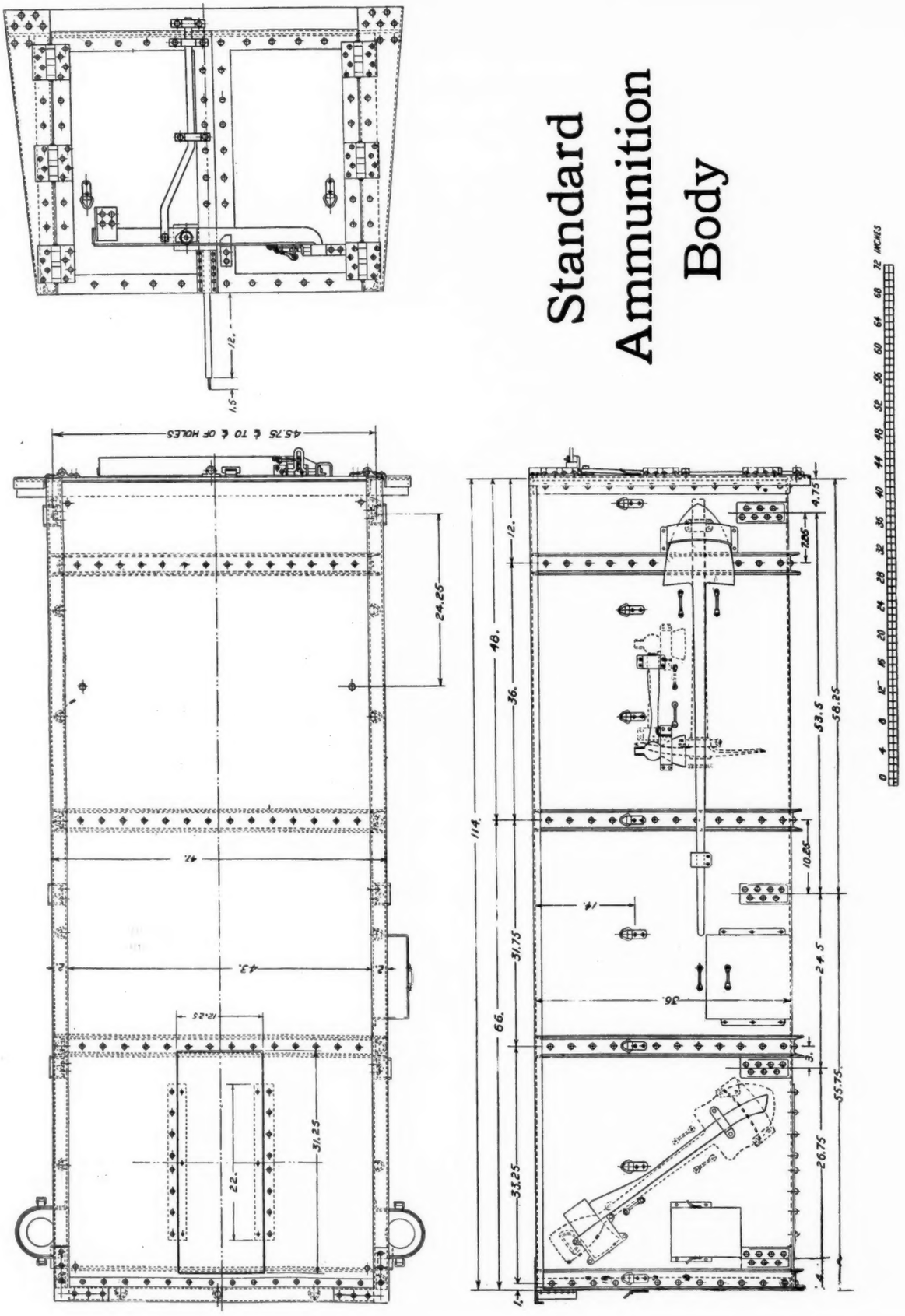
A gasoline tractor developing about 20 hp. at the drawbar would enable farmers to use four or five bottom power plows, the tractor could be used to operate the baling presses and the threshers, and, when better roads are provided within the great stretch of level country, products could be hauled to market in tractor trains.

A carefully conducted demonstration with a tractor capable of using either gasoline or kerosene as a fuel would undoubtedly produce results if given wide publicity.

Stationary Engines Unknown

Stationary and portable gasoline engines are almost unknown in Chile, except in the mining regions, and the biggest demand for the Diesel and semi-Diesel types of engines. Many of the mines are operated by American companies that have purchasing offices in the United States, and requisitions for this class of machinery are generally placed with the New York office, which makes the purchase. As already indicated, most of the motive power on Chilean farms is furnished by portable steam engines; and until the gasoline tractor takes the place of these engines, because of its greater range of action, the development in the sale of internal-combustion engines will be confined to the mining districts of Chile.

Standard Ammunition Body



Deep Frame for New Maxwell

Greater Rigidity of Frame and Better Rear Springs Principal Chassis Changes—Complete Line of New Bodies

THERE has been no change of model in the line of the Maxwell Motor Co. for 1918, the chassis known as the "25" being continued. There are some refinements, which have been added, however, of the detail nature, and in addition the body lines have been considerably altered. The chassis changes concern the electrical equipment and spring suspension principally, although there is a detail change on the engine. While the ignition and starting units remain the same, there has been a change in the wiring. The 12-volt single-wire system is now used on the starter and lights in place of the double-wire method. The starting switch has also been simplified by using a new design of the single pole type and by improving the pedal arrangement. The starting pedal operates the switch and meshes the starter gear with the flywheel. The pedal has an automatic magnetic lock attached, which prevents the starter gear from being thrown in mesh while the engine is in motion.

The improvement in the spring suspension is due to a change in the rear spring, which is now termed a compensating underslung semi-elliptic. This is a 49-in. underslung spring in place of the three-quarter scroll elliptic formerly employed. The change in the spring has provided a lower car, and one which tends to cling to the road more closely, due to the lower center of gravity.

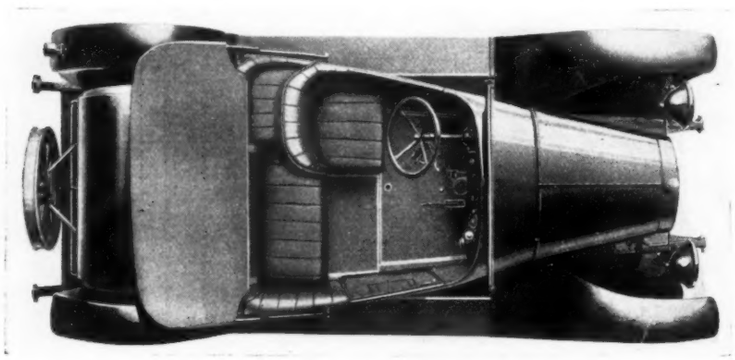
Another detail change is on the engine. The fan belt has been widened in order to give it more life, as this belt also drives the generator. Other than this small change the engine remains exactly the same as last year.

Wheelbase Lengthened

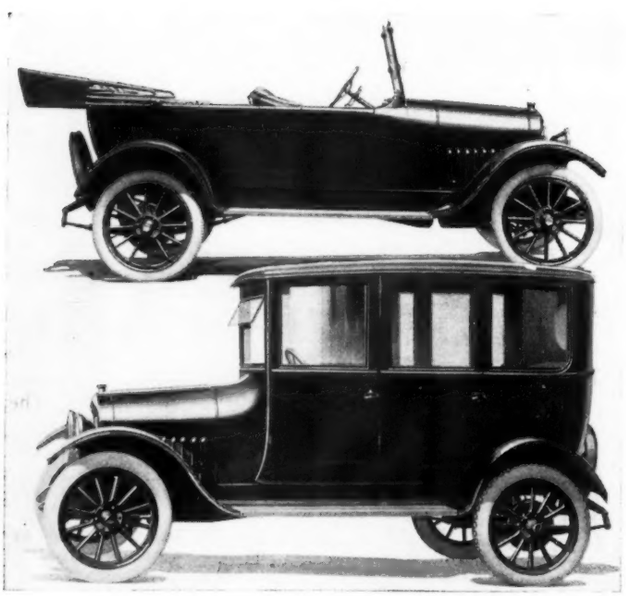
This is the fourth year of the Maxwell "25" chassis without radical change. It has been lengthened gradually since its introduction, and this year the wheelbase has been increased considerably, the change being from 103 in. to 109 in. This lengthening of the wheelbase permits more body room and gives the car a lower and longer effect, as well as a better riding job. To compensate for the increased length in chassis, the channel section has now been increased to 6 in. in depth. Another change which adds considerably to the appearance is the elimination of the splash guards, giving a much wider running board.

Five different styles of bodies are put out on the 1918 chassis, these being the five-passenger touring, staggered seated three-passenger roadster, six-passenger Berline, three-passenger coupé, and a sedan. The roadster and touring car sell for $745 each, while all of the closed types are $1,095. The winter top touring car sells for $855.

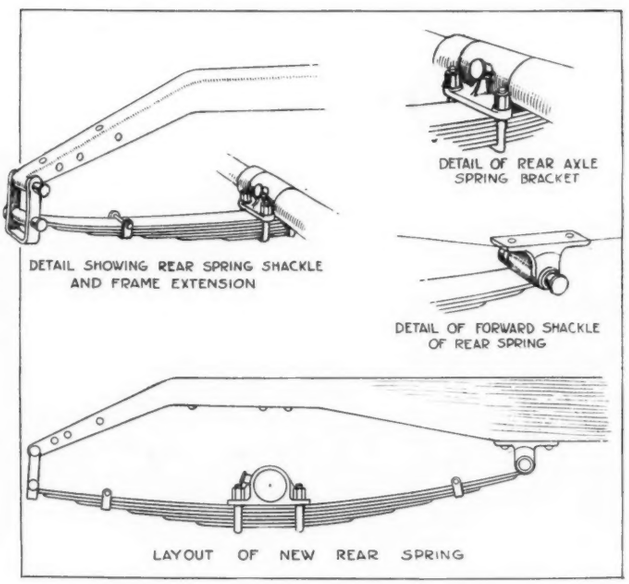
The Maxwell power plant is a four-cylinder L-head block 3⅝ in. by 4½ in., giving a piston displacement of 185.8 cu. in. It is oiled by a circulating splash system, cooled with thermo-syphon and has Simms-Huff lighting and starting with Atwater-Kent ignition. The carbureter is a K. L. fed by gravity, the clutch is a cone, driving through a selective gearbox in unit with the engine to a three-quarter floating rear axle, made by the Maxwell company. The tires are 30 in. by 3½ in., and the wheelbase as stated is 109 in.



Seating arrangement of the Maxwell roadster



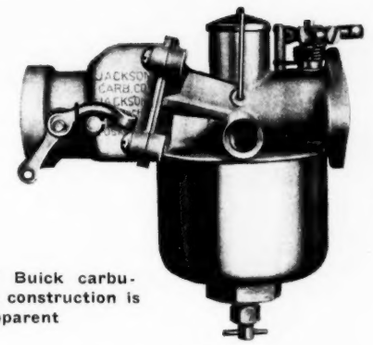
1918 Maxwell touring car and sedan



New rear spring and frame on 1918 Maxwell

Dave Buick Carbureter

Of the Concentric Float Type, with Nearly Horizontal Air Passage—Area of Fuel Passage Controlled by Suction—Entirely Automatic in Action



Outside view of Buick carbureter. Its simple construction is quite apparent

DAVE BUICK, the founder of the Buick Motor Co., has been engaged in carbureter development for some years past and has produced an instrument for which he claims many advantages. It is to be manufactured in all sizes by the Jackson Carbureter Co., Jackson, Mich. Two views of the device are shown herewith, one a regular retouched photograph and the other a so-called skeleton view. With the aid of the reference letters on this latter view and the following description the action of the carbureter will be readily understood.

The fuel enters the bowl through the usual type of valve controlled by a float, which maintains a constant level of fuel in the bowl. The fuel passes from the bowl through the screen shown in the illustration into a cylinder in the center of the bowl. In this cylinder, free to move up and down, is a hollow piston *PP*, having a hook-shaped head, which hangs on the end of the shutter *PS*. This shutter turns on a shaft *RH*, so that it can occupy the position shown in the illustration, leaving the passage through the carbureter wide open, or the position shown by the dotted lines, in which case the passage is closed, except for an opening in the end of the shutter and in the head of the piston.

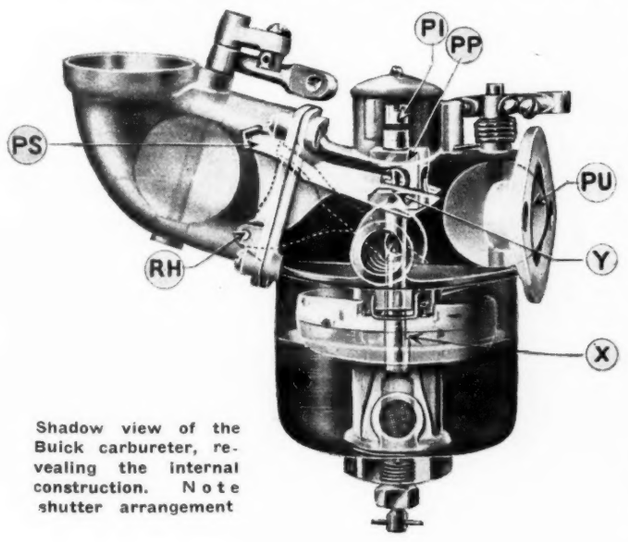
At the slowest motor speed, as when it is running idle, the shutter is in the latter position. The fuel is then drawn up from the hollow inside of the piston through the jet *Y*, and is mixed with the air rapidly passing this jet. The opening of the jet is controlled by a screw, the head of which is indicated at *PI*. As the motor speed is increased by opening the throttle *PU*, the shutter is raised by the increased speed of the incoming air, and this raises the piston. The piston has on its side nearest the throttle a flattened face *X*, so as soon as the piston is raised at all a small opening is made between this flattened face and the cylinder in which the piston travels, and additional fuel is drawn out at this opening.

The face of the piston is flattened very slightly at the top, but deeper and deeper toward the bottom, so that as the piston is lifted by an increasing motor speed, an increasing fuel opening is provided.

Operation of Instrument Automatic

In other words, at any given motor speed a certain amount of air is being drawn into the cylinders. This amount of air raises the shutter and piston to a certain position and therefore makes a certain opening for the fuel, so that the amount of fuel is always exactly the correct amount to form a proper mixture with the amount of air being drawn in. The entire operation of the instrument is automatic—there is no connection between the throttle and the shutter and piston, the latter parts being operated solely by the current of air drawn into the cylinders. This insures the absolute truth of the mixture under all conditions. The shutter floats on the stream of air and supports the piston at the proper position to make a perfect mixture of air and fuel. This is conclusively and astonishingly demonstrated by either pushing down or pulling up the shutter of a carbureter in operation. This results instantly in slowing down the motor, showing that the shutter and piston were in the best possible position.

The graduation of the flattened face of the piston is determined experimentally and does not require adjustment. The only adjustment is of the idle jet by the idle screw *PI*.



Shadow view of the Buick carbureter, revealing the internal construction. Note shutter arrangement

—

Few Changes To Glide

ONE design of chassis, fitted with either a five-passenger touring or a four-passenger roadster body, will be the product of the Bartholomew Co., Peoria, Ill., for the 1918 season. Both models will sell at $1,395 fully equipped. For an extra charge of $200 the company furnishes a detachable sedan top.

The most important change in the design of the Glide is a lowering of the chassis by 1½ in. This necessitated a different drop in the front axle and a new design of pressed steel frame. The object in lowering the frame was to improve the appearance of the car, and this has been accomplished, it is stated, without materially reducing the road clearance. All models are now equipped with slanting windshields and Motometers. Improvements have been made in the tops and curtains of the open types, the curtains being of Jiffy style. On the sedan models the windshield is straight, this being necessary in order to insure a proper fit to the sedan top. All touring models are painted in meteor blue, with black hood, fenders and gear, and ivory white wheels. The roadsters are painted the same color, but an option is given on maroon bodies.

The Glide chassis is equipped with a six-cylinder 3⅛ by 5-in. block motor developing 40 hp. at 2000 r.p.m. It is fitted with a Rayfield carbureter, Stewart vacuum fuel feed from a 16-gal. tank, Westinghouse starting, lighting and ignition system and a circulating splash lubricating system, a 2-gal. supply of oil being carried in the reservoir at the bottom of the crankcase. The cooling water is circulated by centrifugal pump, and there is a two-blade air-propeller type of fan back of the radiator.

The clutch is of the dry disc type and the transmission a three-speed selective type combined with the engine. The drive to the rear axle is a propeller shaft with Spicer universal joints at both ends, and by helical bevel gears with a ratio of 4.64:1. The Hotchkiss drive is employed.

The car has a wheelbase of 119 in. and is fitted with 12-spoke wood artillery wheels equipped with 34 by 4-in. Goodyear tires, of which the rear ones are non-skid. Left steering and center control are employed. The body is of all metal construction and incorporates such features as large doors with concealed hinges, long grain enameled upholstery and high-class appointments.

1917 Tractor Development—III

Many Varieties of Front Axle—Central Pivot Steering Losing Ground to Automobile Type—Great Flexibility Attained in Some Designs

By A. Ludlow Clayden

SCARCELY any two tractors have front axles precisely alike, yet this part should be one of the easiest to standardize. It has not been possible to employ heavy truck axles of standard makes, because of the necessity for giving a transverse rocking movement and precludes the idea of attachment by spring tables. Perhaps it is this fact which has caused the evolution of many ingenious methods of building up axles without the use of drop forgings. The cost of the dies and the difficulty of getting new dies cut at the present time have probably both been factors.

The illustrations on this and the next page show practically all the types of construction used, each being found with variations. Fig. 1 is interesting because the only special parts in it are the stub axles, the whole of the rest of the axle being made from flat steel and standard bolts and rivets. The weight rests on the coil spring in the center, the latter permitting oscillation in any direction. This type of axle is used on several machines of moderate weight and appears to possess plenty of strength; it has, of course, a limited amount of natural springiness.

Fig. 2 is a peculiar form in which the weight is again partly sprung, being carried on the two coil springs. Transverse movement is allowed by a pivot at the middle of the axle. It has the advantage of giving a very large front clearance. The next illustration, Fig. 3, shows a very solidly forged job of Elliot type, the transverse pivot pin being beneath the axle. It is an expensive design so far as first cost is concerned, but it is entirely above suspicion as to strength and durability.

In Fig. 4 the old style of steering is shown, still used on many of the largest machines. Here the axle proper is a square bar, stiffened by being clipped between the two heavy castings. The center pivot is universal, giving both transverse and steering motion.

Fig. 5 is an improvement on the

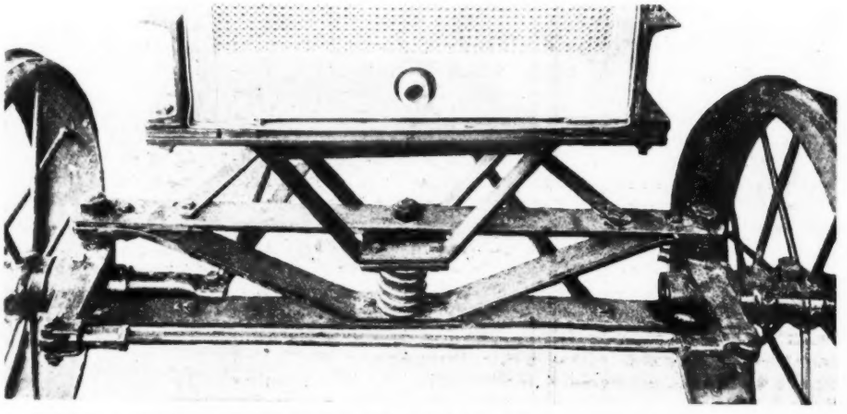


Fig. 1—A built-up tractor axle in which nothing but standard materials are used except for the stub axles

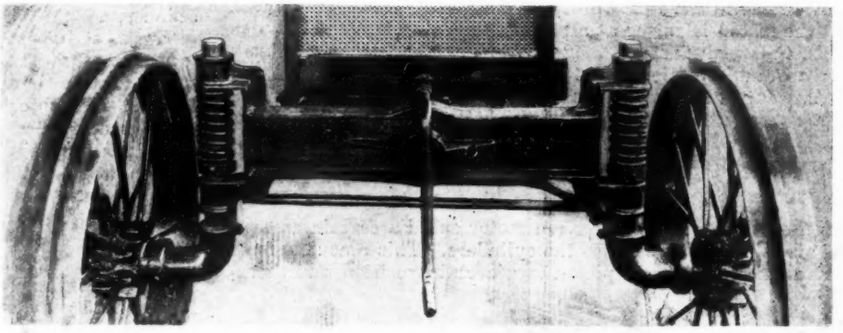


Fig. 2—A peculiar form of axle, with each front wheel individually sprung, the knuckles being slightly telescopic

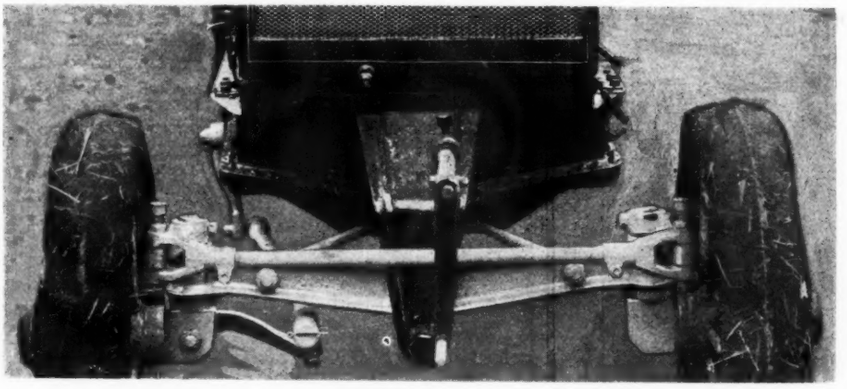


Fig. 3—A very strong forged axle developed from truck practice. The knuckle bearings are particularly large

type shown in Fig. 1, the difference being that the lower member is angle steel strong enough to do all the weight carrying. The function of the upper strip of flat steel is to steady the steering knuckles. This design avoids the use of drop forged parts, except for the stub axles, and is quite workmanlike in appearance; still it probably costs at least as much as a forged axle would after the die charges had been met.

The source of inspiration for the design shown in Fig. 6 is obvious, and there is a great deal to be said in its favor. The leaf spring is the only frame attachment, allowing for side sway, the axle being, of course, steadied by radius rods. The spring is stiff, as compared with motor truck practice, but sufficiently flexible to benefit the rest of the tractor, especially if it is run on a hard surface.

Fig. 7, which is entirely self-explanatory, is probably the simplest of all the constructions illustrated from a manufacturing viewpoint.

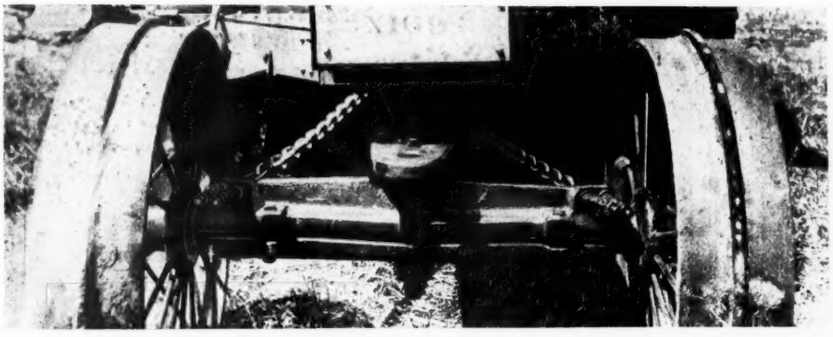


Fig. 4—The old style tractor axle consisting of a steel bar strengthened with castings clamped upon it

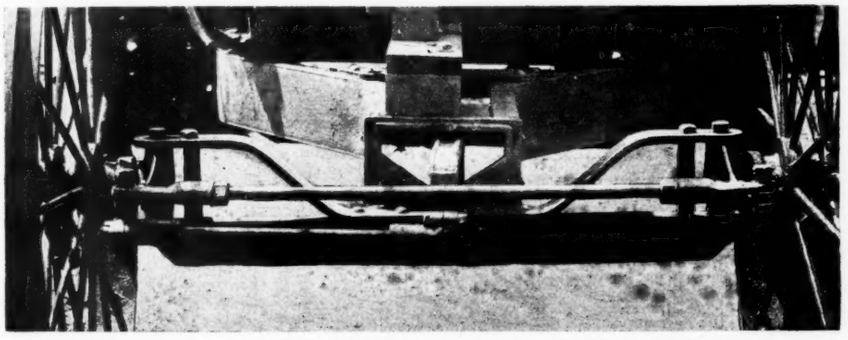


Fig. 5—An axle using angle steel for the strength member and flat stock for steadying the knuckles

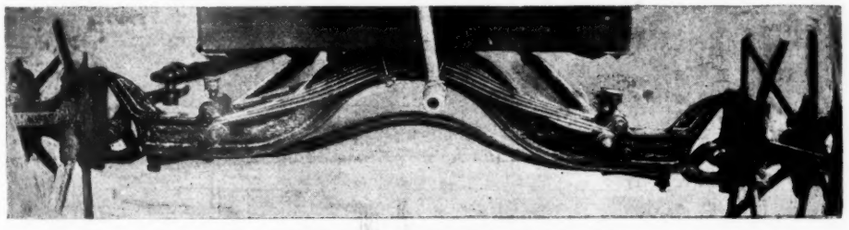


Fig. 6—A design where transverse oscillation freedom is obtained by a leaf spring as on the Ford car

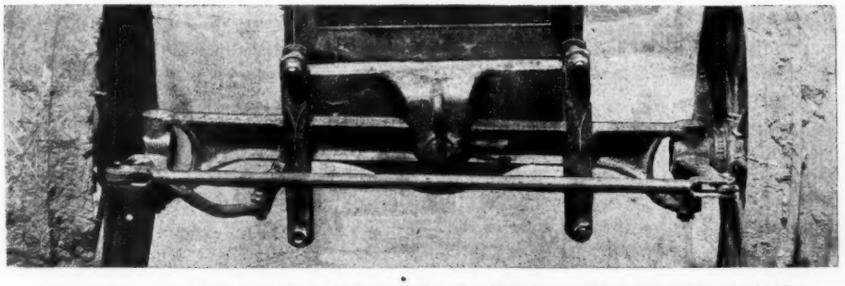


Fig. 7—A very simple type of forged axle steadied by guide bars instead of the usual radius rods

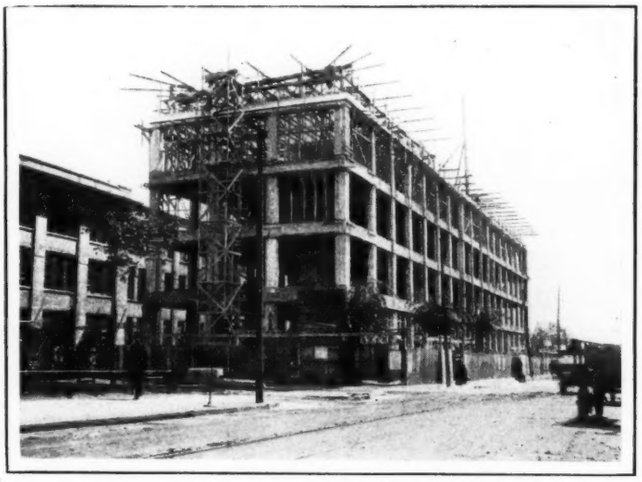
Stock Axles Wanted

It is impossible to look at these illustrations without being impressed with the field that is open for one or two good stock front axles. Of course, there are many variations in tread of front wheels, height of frame from ground, space for attachment of radius rods, and so on, but few of these differences between one tractor and another are necessary.

Probably something like six different forgings would make up an ample range, say, for instance, light, medium and heavy sections in two tread widths. The center of each forging should have a table, something like a spring table only larger, to which the tractor maker could attach a casting carrying the pivot, and provision should be made for the radius rods. A lug near each end, as shown in Fig. 3, should be suitable for this purpose. The axle might be made reversible so that it could be used either way up, giving a different ground clearance with the same wheels or the same clearance with different wheels. The details are for an experienced drop forging axle firm to work out for itself, but by collecting the blueprints from twenty different tractor makers the task of laying out a series of stock axles to meet almost all requirements should be easy.

This front axle matter is treated rather fully here because it is so very typical of much of tractor make-up which is susceptible to standardization of the stock parts sort. This is not the kind of subject which the tractor standards division of the S. A. E. can handle; it is entirely something for individual enterprise. The essentials for tractor front axle making are the possession of or access to a forge plant with some powerful hammers and a machine shop of a very simple kind. The forgings, though large, would be less difficult than those for large truck axles, and the standard of workmanship need not be more than ordinarily good.

Manufacturers Enlarging Plants

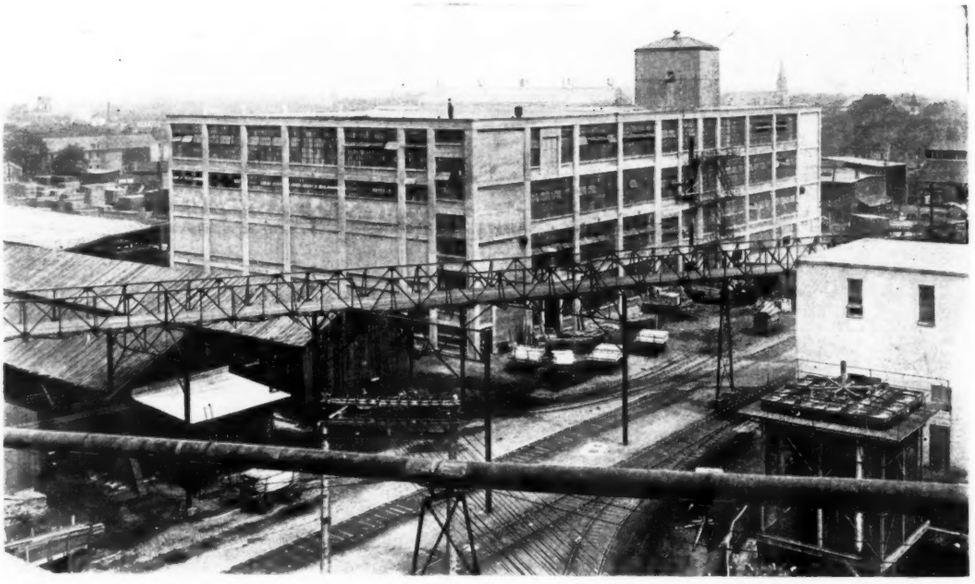


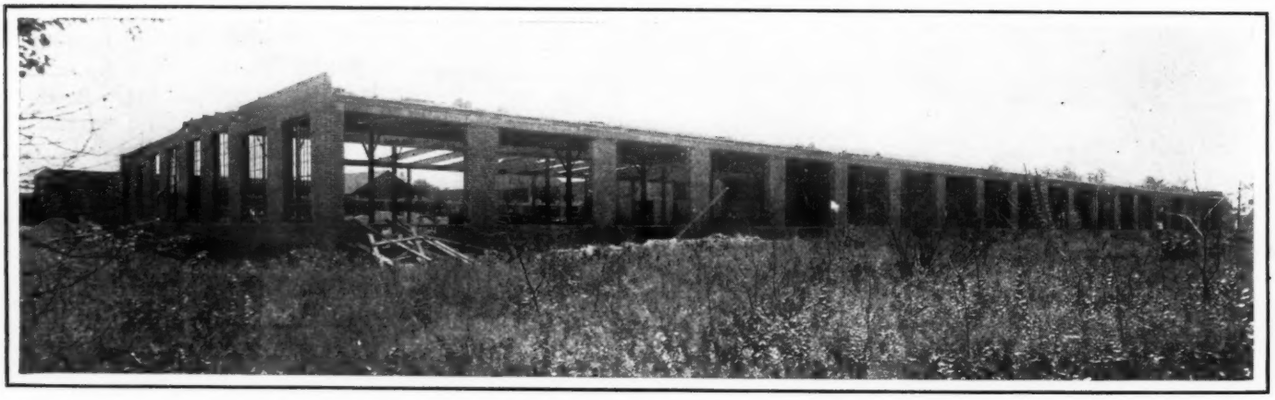
Buick Motor Co.'s office building in process of construction. The structure was completed in 90 days

Above—One of the six-story units added to the Milwaukee plant of the Cutler-Hammer Mfg. Co. It is of reinforced concrete and is a block long

Center — Machine and forge shops being erected by the Studebaker Corp. at South Bend. When finished the buildings will represent an investment of $1,000,000

Below—The new one-story addition to the Russel Motor Co.'s assembly plant. It is 60 by 192 ft.





To Internationalize Tire Sizes

British and French Automobile Industries Consider Either Adopting S. A. E. Tire Dimensions or Holding Conference

IN 1915 the standards committee of the S. A. E. tried hard to obtain some support from British and French tire makers for the setting up of international standards for solid tires. At that time the attention of the foreign manufacturers could not be obtained, but the seed sown two years ago is sprouting now, and there appears to be good reason to hope for an international standard within a reasonable time.

In 1915 W. H. Paull of the Dunlop Co., the largest rubber company in Europe, and one of the largest in the world, visited America, and was in close touch with the international plan of the S. A. E. Our British contemporary, *Motor Traction,* in a recent issue comments editorially on the subject of tire standards, and it is obvious that Paull is still anxious to see the work carried through, as the following extracts will show:

"Mr. W. H. Paull, at a meeting of the technical committee of the motor industries, put forward a suggestion which was adopted by that committee to the effect that the time is ripe for an effort to be made to introduce an international standard of wheel and tire rims for solid rubber tires. The view is expressed that France, Italy, Russia, and the United States will be willing to co-operate with Great Britain in the creation of standards, and this opinion has been forwarded to the Engineering Standards Committee.

"The subject is a very important one, which can be regarded either from the international or from the imperial point of view, or from both. If British manufacturers of vehicles and tires could unanimously agree to the adoption of certain standards the results should have a favorable influence upon manufacturing costs. Thus progress in this direction might be made advantageous to the British industry as compared with all others. If, on the other hand, it is thought to set up standards by agreement with the Allied countries, then the resulting effect upon cost of production would be beneficial to all those countries as against others not included in the group. The more comprehensive the scope of the movement the more advantageous it should be to motor users as regards both cost and convenience.

Approves U. S. Army Standards

"Up to the present we in this country have allowed ourselves to drop rather behind in this matter of standardization of tires and rims. A good example has been set by the United States Government, which, in placing huge contracts with American manufacturers of motor vehicles, has specified the provision of interchangeable rims on all road wheels, so that tires can be removed and replaced without difficulty by a mechanic and his assistant. In the specifications of the motor transport board of the U. S. A. war department for 1½- and 3-ton vehicles for the use of the army the following paragraphs appear, and we are certain they will interest our readers:

" 'The wheels shall be of suitable size and design for the use of 36 in. by 4 in. single solid S. A. E. demountable rubber tires on front wheels and 36 in. by 7 in. single solid S. A. E. demountable tires on rear wheels.

" 'The steel fastenings for demountable tires shall be constructed in accordance with drawing Q. M. G. O., No. T/101. Trucks will positively not be accepted having tires or tire fastenings which differ from those herein specified.

" 'All tires shall be best quality solid rubber tires on hard rubber base with S. A. E. steel rims.'

"It is evidently incumbent upon us in this country to standardize either rims and tires exactly in line with those adopted by the United States, or else something decidedly more advantageous and better from the point of view of the user. The question, then, that deserves most serious consideration is whether we could not adopt as a standard a form of detachable tire and rim, which would enable tires to be easily changed without the use of special machinery and without necessarily removing the vehicle wheel. From time to time various designs have been brought forward conforming to these requirements, but one of the difficulties that have stood in the way of their extended use has been the tendency for the joints, on which easy dismantling depends, to rust up fast during prolonged use upon the road. It ought to be possible to overcome this trouble by suitable research and experiment. We can imagine few subjects more deserving of the prompt attention of the technical committee of the motor industries than this question of tires and rims. The necessary reform can only be brought about by a body so influential and so certain of general support as to be able in effect to compel individual manufacturers either of tires or wheels to fall into line. The committee now existing should, particularly in view of its relations with the Engineering Standards Committee, be in a position to carry through against all opposition any program as to the desirability of which it is unanimously agreed."

Some time ago notice was given of the formation of a joint technical committee of the Institution of Automobile Engineers and the Society of Motor Manufacturers & Traders, on which Government departments were also to be represented. The committee has just held its third meeting, at which A. A. Remington, of the Wolseley Co., was elected chairman for the year and Lieutenant-Colonel R. K. Bagnall-Wild, vice-chairman. A resolution was adopted to the effect that the time is now ripe for a serious effort to introduce an international standard of wheel and tire rims for solid rubber tires. It is believed that France, the United States, Italy and Russia would be willing to co-operate with Great Britain in this matter. A copy of the resolution was ordered forwarded to the Engineering Standards Committee.

It was decided to collect data on several subjects of proposed research, and a suggestion has been made to the committee that a Bureau of Technology be established, where technical information regarding all branches of the motor industry might be obtained, and which might issue a periodic précis of up-to-date information relating to late scientific advancement and its bearing on automobile engineering. Such a service would be of great value to automobile engineers, but it would require the financial support of the manufacturers, though it is quite likely that the Government would make a substantial contribution through the Department of Industrial Research. Another proposal is to the effect that the committee lend its aid for the better co-ordination of engineering training, and steps to this end have already been taken. The committee is represented on all the automobile sub-committees of the Engineering Standards Committee and is doing all in its power to help the work of standardization.

—

Whirling Speeds of Aerial Propeller Shafts

IN *Engineering* for July 20 A. Page presents a mathematical treatment of the problem of the transverse vibrations of a rotating aerial propeller and its shaft, and also an application of the method to several practical problems. Mr. Page finds that the whirling speed of a modern aerial propeller, as now mounted on the engine of an airplane, is very high, and very much greater than the bursting speed of the propeller.

The Hall-Scott Airplane Engine

Of Overhead Camshaft Type, with Two Valves per Cylinder—Cylinders Cast Singly of Semi-Steel —Two-Spark Ignition by Separate Magnetos

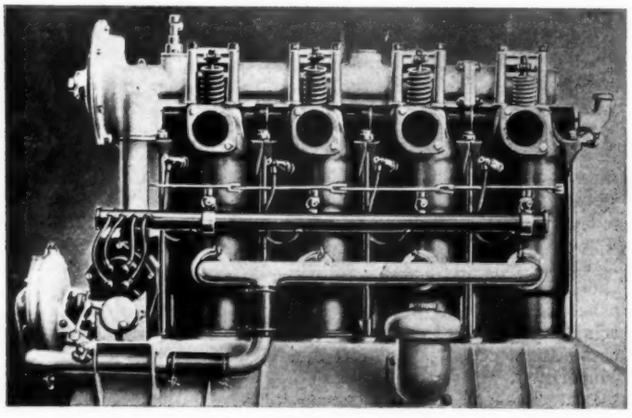
By P. M. Heldt

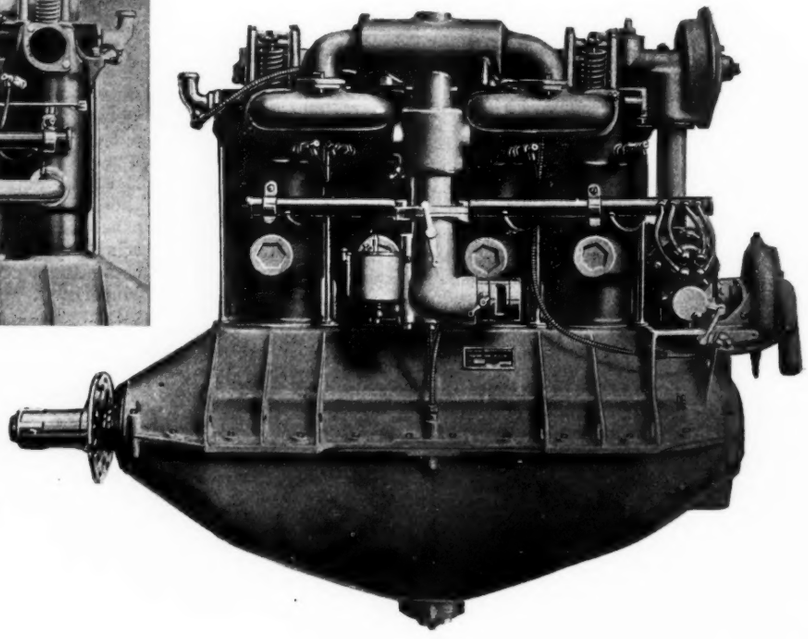
ONE of the most interesting pre-war types of American aircraft engines is the Hall-Scott, which is now being produced in two plants, one in Berkeley, Cal., and the other in Indianapolis, Ind. It is made in two types, a four-cylinder and a six-cylinder, which, however, are very similar in construction. The following description applies particularly to the four-cylinder type which has been approved by the War Department for use on primary training machines. Details of this engine were obtained for this article at the Marmon plant in Indianapolis during the latter part of July.

Having a bore of 5¼ in. and a stroke of 7 in., the piston displacement is 606 cu. in. and at 1400 r.p.m. the piston speed figures out to 1633 ft. per min. Also, as the engine is required to develop 103 hp. on the brake at 1350 r.p.m., it must develop a brake mean effective pressure of 113 lb. per square inch. Each cylinder is a separate casting of semi-steel, with the water jacket and head integral. An interesting feature of construction is the method of holding the cylinder castings down to the crankcase. For this purpose ten ½-in. rods are used, which not only hold the cylinders in place on the crankcase, but extend through holes in the webs in the top half of the crankcase and also serve to hold the caps of the crankshaft main bearings in place. Each cylinder casting is provided with lugs at the four corners, and these lugs are drilled and partly milled away, in such a manner that when the remaining portions of the lugs of adjacent cylinders abut, they form a hole for the retaining rod to pass through, which thus clamps down both cylinders. To make this method of cylinder attachment practicable it is, of course, necessary that all cylinders be machined to exactly the same lengths between their bottom flange and the top of the holding-down lugs. The two outer lugs on the end cylinders remain complete and the holding-down rods pass through these lugs.

In order to reduce the weight of the cylinder to a minimum the water jacket is turned off on the outside from the lower end over the whole of that section where there are no bosses. Then the upper portion of the cylinder which cannot be turned is cut down with a hollow end mill in a vertical milling machine, to reduce it to the same diameter as the lower portion. After the cylinder is bored it is center drilled and counterbored at the top end, and it is then put into a lathe and turned off where possible as described. There are large core holes at the bottom of the jacket on both sides. One of these holes is plugged and the other is used for the water inlet. When completely finished each cylinder weighs 26 lb.

The valves are located in the cylinder heads and are operated from an overhead camshaft through short tappet levers. There are two valves in each cylinder, one inlet and one exhaust valve. They have a clear diameter of 2½ in. and are inclined 16 deg. against the cylinder axis. Both valves are seated directly in the cylinder head, which means, of course, that in order to regrind a valve or replace it, the cylinder has to come off the crankcase. The reason for seating both valves directly on the metal of the cylinder casting is that in this way it is possible to thoroughly cool the valve seats. The valve passages are elbow-shaped and open to the sides, the inlets to one side and the exhaust to the other.





Above—Exhaust side of Hall-Scott engine, showing method of holding down cylinders. Right—Inlet valve side of engine, showing carbureter and manifold. Note also the flexible tubes to the inlet manifold jacket and the oil distribution pipe

On both sides of the cylinder castings there are openings for water connections. These bosses are faced off even with the lugs by means of which the cylinders are held down to the crankcase, which facilitates the machining of the cylinders. The water joint bosses are bored out and three lengths of steel tube are inserted, each connecting a pair of adjacent cylinder jackets. A short piece of rubber hose is placed over the water connection bosses and is clamped tight by means of a hose clamp. Water from the circulating pump enters the jackets at the bottom, through a separate connection to each jacket, and it leaves the jackets through an elbow fitting at the rear of the engine.

Pistons of Die-Cast Aluminum

Die cast aluminum pistons are employed. These are of quite unusual design in that the piston head and a considerable portion of the skirt are about ½ in. thick, the object in using such heavy walls being, of course, to facilitate the flow of heat from the head to the skirt. The piston is cut with grooves for three compression rings near its top end and with a groove for another ring directly over the center of the piston pin. Depressions are formed on the piston surface where the bosses are located, so that any slight distortion of the bosses will not affect the bearing of the piston in the cylinder. Each piston casting in the rough state weighs 6½ lb. and after being fully machined, 4 lb. There are no ribs inside the piston to strengthen the bosses and help conduct away the heat, these being rendered unnecessary by the heavy wall thickness employed. The bosses are very firmly secured to the skirt, however, by large fillets; in fact the bosses really form solid segments inside the cylindrical skirts. A single pin screw holds the piston pin in place, an additional safety device against drifting being provided by the lower piston ring. All of that part of the skirt not occupied by ring grooves has oil grooves cut upon it. The skirt wall is tapered from about the axis of the piston pin to the open end, while the head is plane. Over the whole length of the skirt the piston is finished up to 0.020 in. below the nominal cylinder bore, and on the lands it is finished to diameters which are 0.025, 0.030 and 0.035 below the cylinder bore respectively.

Connecting Rods of Drop-Forged I-Sections

Connecting-rods are made from drop forgings of I-section and are finished all over. A bronze bushing is forced into the wrist pin end and is broached out to a diameter of 1⅛ in. As an indication of the accuracy of the workmanship required on engines of this type it may be stated that the limits on the wrist pin hole are —0 and +0.00025 in. An oil tube extends from the bottom bearing of the connecting-rod up alongside of the web of the shank to the top bearing. The connecting-rod cap is held in place by two bolts with castellated nuts and split pins. Shims are inserted between the connecting rod head and cap for purposes of adjustment. The bearing bushing consists of two-half shells of bronze which are babbitt lined. The bore of the big end of the connecting-rod is 2 in. and the limits of this dimension are —0.001 and +0. The length of the crankpin bearing is 2 7/16 in. All of the connecting-rods are balanced by weighing, the weight of the finished rod being 3 lb. 12 ounces and the limits ±¼ ounce.

Five-Bearing Crankshaft

A five bearing crankshaft is used, having main journals 2⅛ in. in diameter (— 0.001 + 0 in.). All intermediate bearings are 2 in. long (0.005 in.). The forward end bearing is 2¼ in. long and the rear end bearing 5 in. Three-quarter inch holes are drilled through all of the journals of the crankshaft with the object of lighting it, and also in the case of the crankpins, to help in the lubrication. To a forged flange at the forward end of the crankshaft is bolted the camshaft pinion. The crankshaft is a chrome nickel steel forging and is machined all over. It is provided with a thrust collar to the rear of the rear bearing, back of which is mounted a double ball thrust bearing. The propeller hub seat is turned to a taper and cut with a keyway. Being made of alloy steel the crankshaft is, of course, heat treated and after heat treatment it shows the following physical properties:

Elastic limit	115,000 lb. per sq. in.
Ultimate strength	135,000 lb. per sq. in.
Elongation	16.4 per cent
Reduction of area	53.7 per cent
Brinnell hardness	293
Izod impact test	40 ft. lb.

Before machining the crankshaft is annealed to 45-50 scleroscope hardness. After the crankshaft has been finished it is subject to inspection, which must show that all crankpins are parallel with the main bearings to within 0.001 in. and are not over 0.0005 in. out of round. With the shaft mounted in front and rear bearings the center bearing must not run out to exceed 0.01 in.

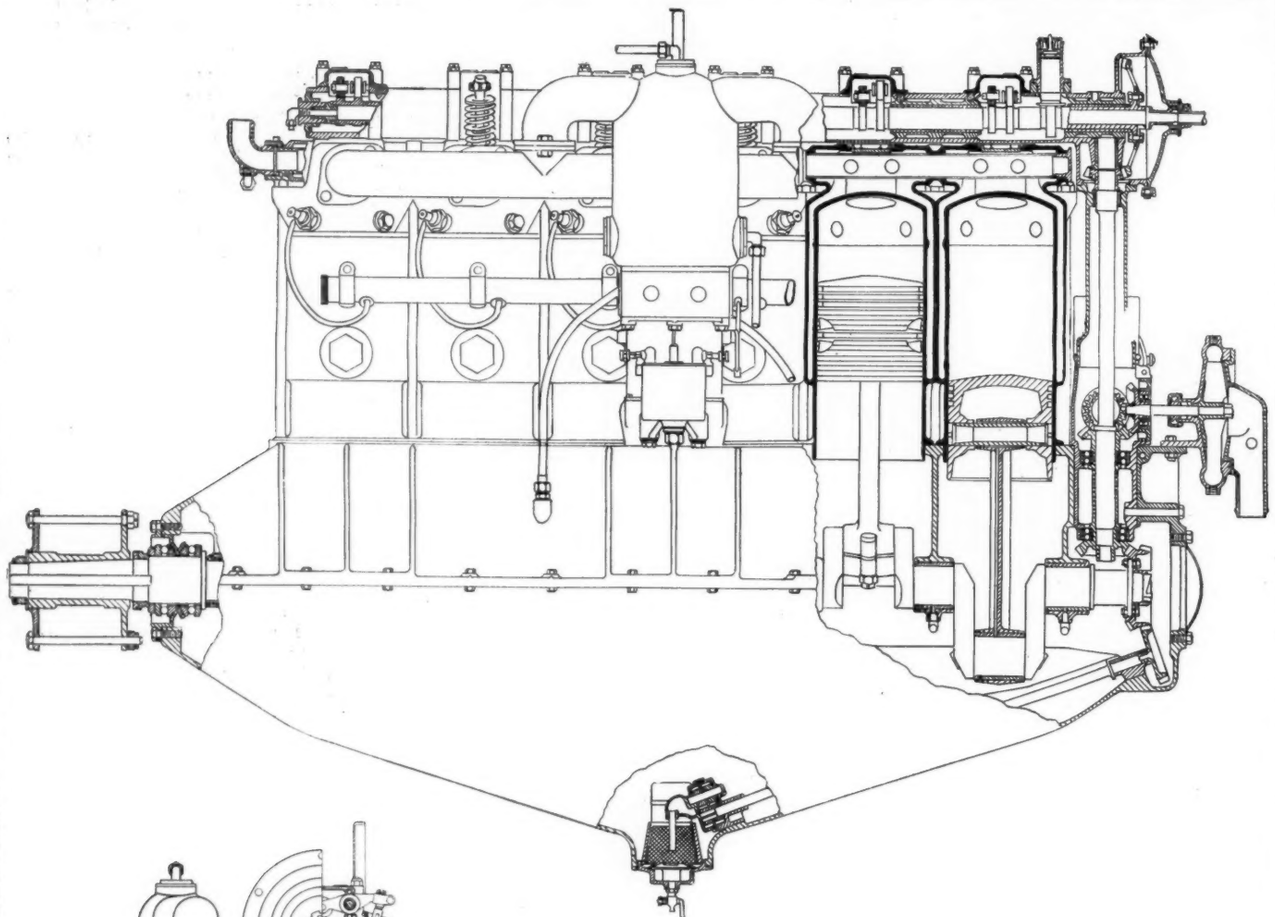
The crankcase is made of two aluminum castings bolted together in a plane through the axis of the crankshaft. The crankcase is scraped both inside and outside—inside before machining and outside after machining—the object being to get rid of all sand and foreign matter, so it cannot get into the oil. In the new Marmon factory it is planned to boil all castings in superheated water at 500 deg. Fahr. to relieve all strains before machining. No gasket is used between the cylinder bottom flange and the top of the crankcase, these surfaces being hand scraped. The joint between the halves of the crankcase is also hand scraped, yet a paper gasket is used in this place. Four supporting legs are cast integral with the top half of the case, these being substantially ribbed, though the ribs are of very thin section. There is a combined breather and oil filler at the left-hand side.

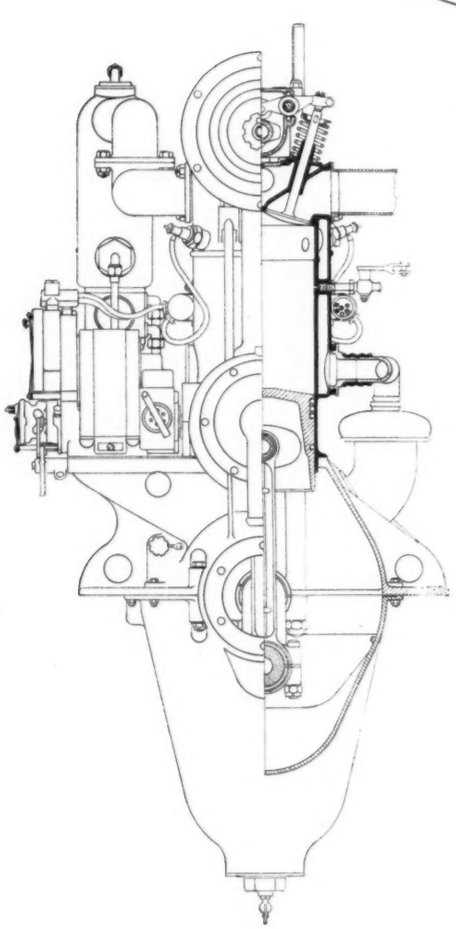
An oil pipe is cast in the crankcase through which oil is distributed to the different main bearings. The top half of the crankcase is cast with a web for each intermediate bearing, and this web is formed with vertical, cylindrical enlargements through which the holes for the cylinder holding-down rods are drilled. Lubricating oil is positively delivered to each of the main bearings. It will be noticed that the crankcase lower half slopes toward the center, at which point there is located a gauze filter, secured to a removable plug, in the center of which there is a drain cock. Adjacent to this filter and supported on the bottom of the crankcase, is an oil pump of the gear type, the inlet pipe of which extends into the filter. The pump is mounted at an angle and its driveshaft extends forward inside the crankcase practically parallel with the bottom of the case. At the forward end it has secured to it a bevel pinion which meshes with the bevel pinion on the forward end of the crankshaft. This latter bevel pinion is a double faced pinion, one set of its teeth serving to drive the pump shaft and the other set to drive a vertical shaft connecting to the camshaft running across the tops of the cylinders.

Vertical Shaft Runs at Crankshaft Speed

The vertical shaft, which is mounted in two combined radial and thrust ball bearings at and near its lower end, and in a plain bearing at its top end, runs at crankshaft speed. Directly above the intermediate ball bearing this shaft carries a bevel pinion which meshes with three other bevel pinions of the same size as itself. The pinion forward of the vertical shaft drives the circulation pump, and the other two pinions, which are mounted on the common axis, drive the two Dixie high-tension magnetos, located on opposite sides of the vertical shaft. The vertical shaft is inclosed in an aluminum housing, which is formed with large openings toward the front and both sides at the point where the drive for the magnetos and the water pump is taken off. The bevel gears for the magnetos and pump are mounted directly on the shafts of these devices and no extra bearings are required in the housing. Aluminum caps are fitted over the magneto and pump shafts, back of the driving gears. These caps enter the openings in the housing for the vertical shaft and are clamped tight in same.

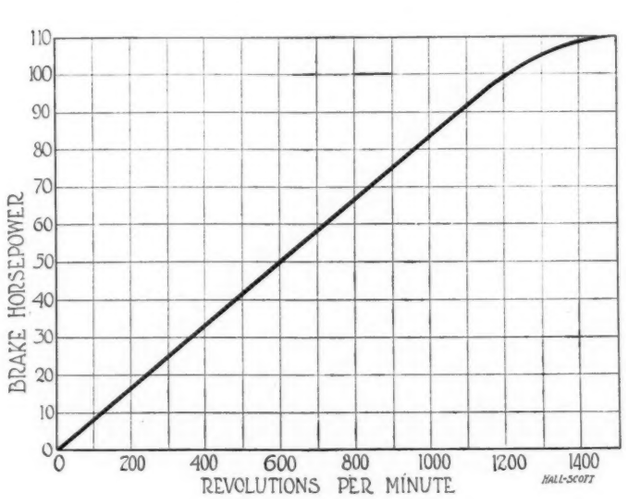
Located on top and extending lengthwise of the engine is the hollow camshaft which has an outside diameter of 1⅛ in. and an inside diameter of 11/16 in. At the forward end this camshaft is formed with an integral flange to which its driving gear is bolted. The cams are forged integral with the camshaft, cut and ground accurately to size and hardened. They act on the valves through the intermediary of short rock levers which have arms of equal length and are provided at their outer end with set screws for adjustment purposes.





Internal Construction and Performance of Hall-Scott Airplane Engines

Above—Longitudinal elevation, partly in section, of the six-cylinder engine. On the left—Front elevation, partly in section, of the same engine. Below—Horsepower curve of the four-cylinder engine. Note the camshaft and accessories drive and the heavy section of the piston walls



The valves have a lift of ⅜ in. and the set screws are adjusted to give a clearance of 0.020 in. The camshaft is located in a camshaft tunnel, consisting of an aluminum casting in one piece which is bored out and has aluminum bearing bushings inserted which are of larger outside radius than the maximum radius of the cams. These bushings are made in halves and held together by means of two machine screws, with brass shims between. There are babbitt liners with oil grooves in these bushings and the shims hold the babbitt in place. The boring of the camshaft tunnel is an interesting operation which is performed in a horizontal milling machine the tool of which turns, but has no axial movement. The tunnel casting is fastened in a jig holding it to the carriage of the miller. It is reamed on the machine and later line-reamed on the engine so that all bearings will come in perfect alignment.

Boring Operation

In performing the boring operation use is made of as many tools as there are bearing seats to be bored. These tools are equally divided over the circumference and are so spaced longitudinally that not all of them break corners at the same time. The camshaft tunnel and its four cover plates are held to the cylinders by sixteen 5/16 in. studs with castellated nuts. The rocker arm shafts, which are hollow, are clamped between the tunnel and the covers, and in order to obviate the danger of the shafts turning in their seats if the lubrication of the rocker arm should fail, those portions of the shafts by which they are clamped are left rough. Bronze bushings are inserted in the rocker arms. Felt packings are placed in grooves formed in the tunnel casting and the cover plate above and below the rocker arm hubs respectively, so as to effectively protect the cam mechanism against dust and grit and permit of efficient lubrication. Cupped spring washers of pressed steel are used on the valve stems, which latter are slotted transversely for keys upon which the spring washers rest and which are held in place by them. As an additional safeguard to prevent the key from coming out it has small holes drilled through it at each end and a brass wire is passed through both holes and has its ends twisted together. Two stock oilers with spring ball closures are inserted in each cover plate over the cam tunnel.

At the top of the vertical shaft is located the bevel gear set, giving the 2 to 1 reduction for the overhead camshaft. The large bevel gear is inclosed in a housing formed integral with the camshaft tunnel. This is cast open at the forward end and provided with a cover plate, a paper gasket being inserted at the joint. From the forward end of the camshaft a speedometer drive is taken off.

The centrifugal water pump at the forward end has an aluminum housing and a bronze propeller. It is provided with a supporting bracket which is bolted to the crankcase top half. As it leaves the pump the water passes through a pipe leading under the magneto base on the left hand side and which then bends upward and through a hose joint connects with the aluminum water manifold, each branch of which connects to one of the cylinder jackets by a short length of hose.

On former models of the Hall-Scott engine the lubricating oil was passed through an inlet manifold jacket, which resulted in the oil being cooled and the inflowing charge heated. This practice is no longer followed, however. The oil pump already referred to draws its supply from the sump and delivers it to the horizontal oil distributing pipe cast in the upper half of the crankcase, whence copper tubes with flared joints connect to each of the main bearings. Oil is delivered to the bearings under a pressure of about 10 lb. per square inch. From the front end of the distributing pipe a small flexible tube leads up outside the engine at the rear to the camshaft, with which it has a packed revolving joint. The oil, therefore, flows right into the camshaft, from which it emerges through radial holes, there being no pressure on the oil at this point. At the ends of the crankpins, sheet metal oil catchers are placed over the hole in the crankpin. These catch the oil collecting on the crank arms and which is forced outward along the arms by centrifugal force, leading it into the hole in the crankpin. Thence it flows through radial holes in the crankpins to the crankpin bearing surface and up through the oil pipes secured to the connecting-rod shanks to the piston pin bearings. Two horizontal sheet metal baffle plates are secured inside the lower half of the crankcase. These are formed so as not to interfere with the sweep of the connecting-rod heads, and a space of about 6 in. is left between them at the middle. At the rear end the crankcase is closed by a drop-forged end plate which holds the thrust bearing in position. At the front there is a pressed steel cover plate secured by cap screws. About 5 gal. of oil is carried in the engine base.

Zenith Aluminum Carbureter

A 2-in. Zenith aluminum carbureter is used and connects to the inlet ports of the cylinders through an aluminum inlet manifold made in three parts. This manifold is water jacketed so as to insure thorough vaporization of the fuel. Short lengths of steel tube with a flange brazed on are used for exhaust pipes on each cylinder.

The high tension cables from the two magnetos are led along opposite sides of the engine in neat tubes of insulating material and connect to the spark plugs which are screwed into bosses formed in the cylinder castings. The wiring is thus exceedingly simple. The two plugs being located on opposite sides of the combustion chamber, the very best effect from the two point ignition should be obtained. Petcocks are screwed into other bosses formed in the cylinder castings and are all connected together by a link so that the operator can open and close them from the seat.

The engine complete, but without oil, weighs 410 lb. and is rated at 100 hp. Having a piston displacement 606 cu. in., it develops 1 hp. for every 6.06 cu. in. in displacement. In some tests, of which the writer saw the records, the cooling water entered the jackets at 146 deg. Fahr. and left at 160 deg., 155 lb. of water being circulated per minute. For the lubrication of this engine cylinder oil having a flash test of not less than 400 deg. Fahr. and a viscosity of not less than 75, taken at 212 deg. Fahr. on the Universal (Saybold) viscosity meter, is recommended. These requirements are met by Zeroline heavy duty, Mobiloil B and Aristo oils among others. The oil consumption is ½ gal. per hour or 0.039 lb. per hp. hr.

A Fireproof Varnish for Airplane Wings

AT the present time the wings of airplanes are treated with a dope consisting of dissolved gun cotton or similar material which is highly inflammable. This treatment is given the surfaces in order to make them air tight, impervious to moisture and absolutely smooth. It is not necessary to dwell upon the danger to the operator and the machine resulting from the inflammable nature of this dope, and the frequent accidents resulting from it are reflected in reports from the front telling of airplanes having been shot down and having dropped to the ground in flames.

Parker R. Bradley, connected with Weeks & Co., New York, has invented a varnish which when applied to the wings of airplanes renders them fireproof. A demonstration of the effectiveness of this treatment was given at Newark, N. J., some time ago, and moving pictures of this demonstration are now being shown in the theatres. A flaming torch was applied to an airplane wing which had been treated with the Bradley varnish and over which some gasoline had been poured, and although the frame was enveloped in flames for a while, the blaze quickly subsided and the wings and frame remained intact, though they were slightly charred.

Weeks & Co. have developed an improved process of applying the varnish to the surfaces of airplane wings. Heretofore this work has been done by hand, and about all that a workman has been able to do in a work day has been to apply one coat to a complete biplane. By the Weeks process the varnish is applied by machine and the coat is then dried in an oven, whereby a great saving of time can be effected.

New Marmon Aero Engine Factory*

Building Laid Down and Some of the Tool Equipment Already on the Ground—First Order Hall-Scott Engines Secured

By P. M. Heldt

WITHIN a period of 2 months from the time it decided to build airplane engines for the Government, the Nordyke & Marmon Co., Indianapolis, has arranged details of production, contracted for a factory designed for this special purpose, secured machine-tool equipment, and arranged with the Hall-Scott Motor Car Co., Inc., San Francisco, to manufacture its type of engine.

Several months ago, shortly after the Airplane Production Board of the Council of National Defense had been organized, a representative of the Nordyke & Marmon Co. visited Washington and attended some meetings of the board. Plans for the production of a huge air fleet were then assuming a concrete form. It was realized that, first of all, a large number of training planes would be required in order to teach soldiers the art of flying. Several designs of engines suitable for this purpose were available in this country, some of our manufacturers already having supplied the Allied Governments with engines for this purpose. As a result of the investigations of the Airplane Production Board, two designs of engines were at once approved for primary training. One of these was the Hall-Scott A-7-A engine, made by the Hall-Scott Motor Car Co., Inc.

It was at once seen that the existing factory facilities of the two companies whose engines had been approved would not nearly suffice to meet the requirements of the Government, which called for the production of thousands of engines inside of a year. The Nordyke & Marmon Co., which has had long years of experience in the manufacture of high-grade automobiles and of milling machinery, immediately offered to co-operate with the Government, although its regular lines showed no signs of slackening as a result of the declaration of war. This was about the beginning of June. How fast things have been moving since that time may be realized when it is stated that at the present the steel frame work of a new, modern factory that is being built specially for airplane-engine production is all up, and much of the machinery required is already on the spot.

The first thing the Marmon company did was to enter into an agreement with the Hall-Scott company whereby the Marmon company secured the right to produce the Hall-Scott engine and at the same time assured itself the full co-operation of the Hall-Scott organization in getting ready for production. Papers were signed about June 12 and immediately a delegation of foremen and department chiefs from the Marmon factory went to San Francisco to study production methods in the Hall-Scott factory on the spot. This delegation was headed by Mr. Shafer, superintendent of the Marmon plant. When they returned, some time later, they brought with them not only a complete engine of the type to be built, but also a complete set of parts and some such fragile objects as the cores used in casting the cylinders, which were packed in such a careful way that they reached Indianapolis undamaged.

In explanation of the reason for shipping these cores it may be stated that in an airplane engine having cast cylinders accurate core work is a prime essential, as otherwise it is not possible to get the weight of the finished cylinders down sufficiently and to obviate the loss of many partly finished castings. By bringing the cores from the Hall-Scott factory the Marmon core makers were given an opportunity to study the methods developed to obtain results. Four men from the Hall-Scott plant also came East to assist the Marmon organization in getting production of the airplane engines under way.

Although the Nordyke & Marmon Co. already possesses a very extensive plant, part of which is specially laid out and equipped for the manufacture of gasoline engines, it decided to build an entirely new plant for the manufacture of airplane engines. In reaching this decision the company was guided by several considerations. In recent years it has considerably developed its automobile business and has built up a dealer organization throughout the country, and the company felt that in justice to its dealers it should not take a step that might thwart its ability to meet the demand for its passenger cars. There was no decline in the demand and the company did not enter this new business to keep its plant going, but rather from a sense of patriotic duty. Secondly, it was felt that much new equipment would be required in any case, and that by building a new factory this equipment could be placed to the best advantage and all the conditions made the most favorable.

The main building of the new factory will be a single-story saw-tooth roof structure. The lower part of the side walls will be of brick, the upper part of steel and glass. There will also be two buildings for testing.

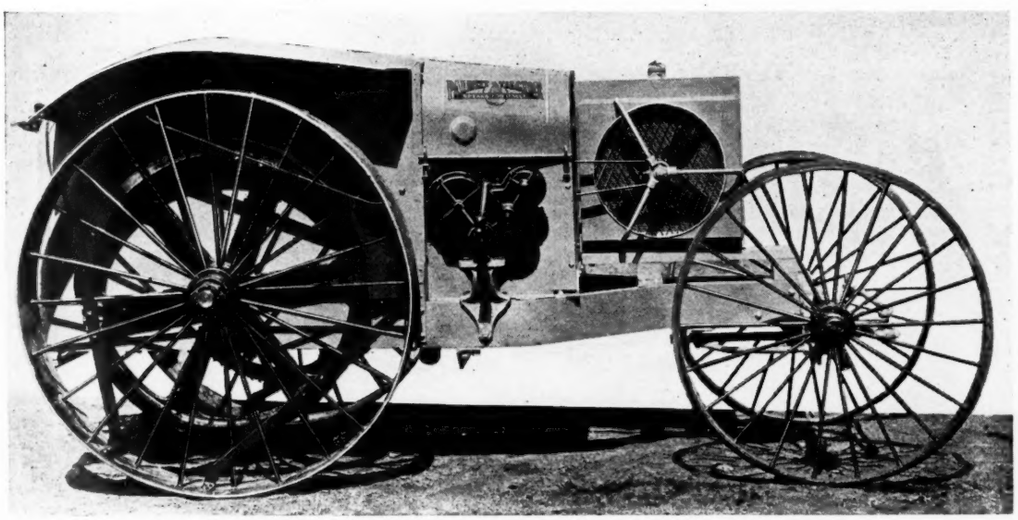
A comparatively large amount of space is required for testing, dismounting and assembling, as each engine, after assembling, must first be lapped in for a day by means of an electric motor, then run in for a day under its own power, then submitted to a Government test under 90 per cent load and finally submitted to a full-load test. Between any two tests the engine is completely taken down, all parts are carefully cleaned and inspected, all those showing the least signs of wear being rejected, after which the engine is reassembled.

Meanwhile, a "jig committee," consisting of some of the Marmon company's tool experts, together with men from the Hall-Scott plant, is formulating production plans and designing jigs. It may seem remarkable, in view of the state of the machine tool market, that, although the whole enterprise was started only a couple of months ago and the buildings are not yet completed, some of the machine tools are already on the ground. But it must be remembered that airplane engine production is priority work, and—to quote the Marmon company—the Government assisted wonderfully in promptly securing equipment.

*This article was written on August 1, but its publication had to be deferred for good reasons.

Parrett Tractor a Four-Wheel Type

Adapted for Either General Farm Work or for the Cultivation of Rice Fields—Direct-Driven Belt Pulley and a Special Rear Axle Construction Points of Mechanical Interest



Side view of Parrett tractor, showing the high front wheels and transverse engine mounting, which is also arranged for ready accessibility

A LOW center of gravity, due to an underslung frame; flexibility of the running gear, permitting it to accommodate itself without strain to uneven ground; a short turning radius, notwithstanding the use of large diameter front wheels; transmission through spur gears exclusively, and the mounting of the belt pulley upon an extension of the engine shaft, thus eliminating gearing in the belt drive, are the most important advantages claimed for the Parrett tractor, manufactured by the Parrett Tractor Co., Chicago, at its works in Chicago Heights, Ill. The machine is of moderate size, having a rating of 12-25 hp., according to the usual tractor rating formula. It is made in several slightly different models. The standard model, of course, is built for plowing and general farm work; a modified design for use in rice fields, where the ground is usually very soft, has rear wheels 18 in. wide instead of 10 in. and front wheels 7 in. wide instead of 4 in. A model for orchard work is also in preparation.

Kerosene Vaporizer Fitted

Aside from the engine, practically every part of the tractor is built in the Parrett works. The engine is a Buda model TU, a four-cylinder design of 4¼-in. bore by 5½-in. stroke. It is not necessary to go into the details of this engine, as it is a standard type with the Buda company and is well known to our readers. However, some few additions to the engine are made by the Parrett company to adapt it to this particular line of work. Thus, for instance, a large sediment trap is fitted to the bottom of the crankcase at the center, this being made necessary by the fact that tractors are usually enveloped in a cloud of dust and it is impossible to keep all of the dust out of the engine.

A Kingston 1¼-in. carbureter is fitted, and the engine will operate on either gasoline or kerosene. It is usually equipped for the use of kerosene, the Parrett company having evolved a special vaporizer, of which a sectional view is shown on another page. This vaporizer is fitted between the carbureter and inlet manifold. It consists of a casting in the form of a venturi tube with an integral jacket. The venturi tube is provided with circular flanges on the outside. The hot gases from the exhaust manifold, as they pass down through a vertical tube, are deflected and compelled to pass through the vaporizer jacket, except for a small fraction which escapes through a bypass in the deflector plate. The lower part of the vertical exhaust pipe is surrounded by an air heater consisting of two concentric sheet metal tubes with asbestos filling between. This tube is closed at both ends, but has an air inlet on one side and an outlet on the other, from which latter a flexible tube connects to the air inlet of the carbureter. Thus nothing but hot air is furnished to the carbureter and additional heat is supplied to the mixture as it passes through the venturi tube between the carbureter and the inlet manifold.

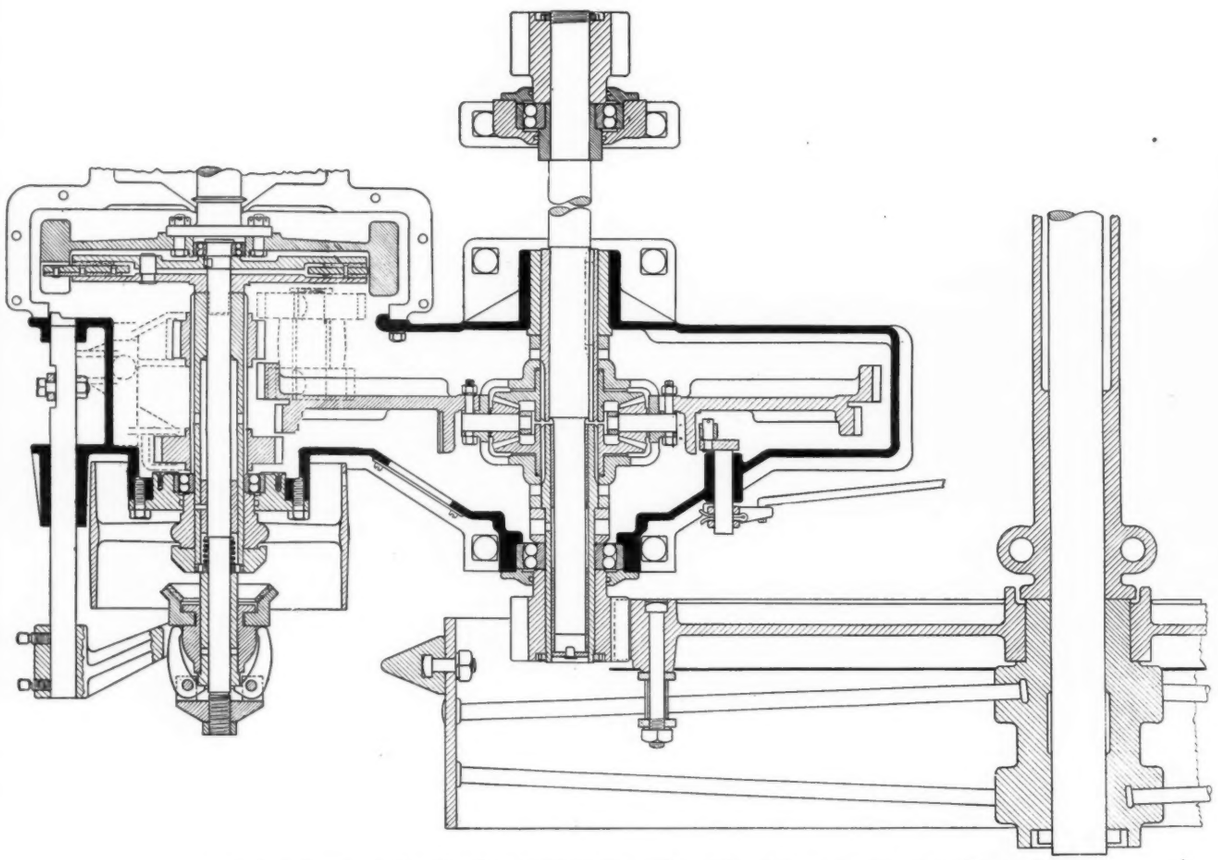
Water Admission to Inlet Pipe

On the inlet pipe directly above the vaporizer there is a water connection which is controlled by a valve which can be conveniently operated from the driver's seat. In case the engine begins to labor, or shows signs of overheating, the driver can admit a small amount of water to the cylinders through this valve, which will overcome the difficulty. The air is taken into the carbureter through a Bennett air cleaner which works on the centrifugal principle. The use of such an air cleaner, it is claimed, increases not only the life of the engine, but that of the carbureter as well. A centrifugal governor is fitted to the engine, which connects to the carbureter throttle valve, and there is, of course, also provision for hand control of the engine speed. The hand control and governor control are so inter-connected, by means of an ingenious mechanism, that the throttle can be set by hand for any speed desired, within the normal working range, and the governor will keep the engine running at substantially this speed.

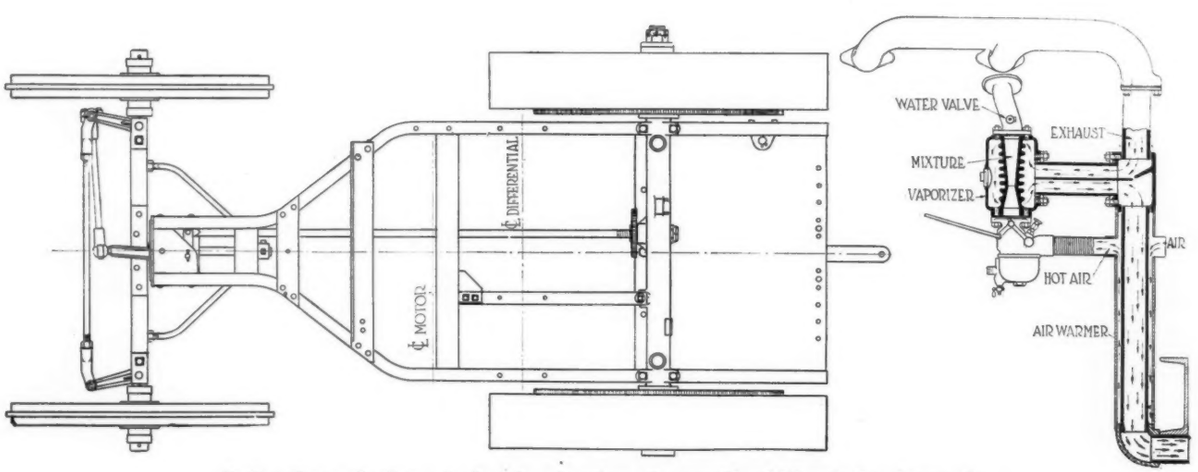
Engine Arranged Transversely

It will be noticed that the engine is set transversely on the frame, which is contrary to automobile practice and to the general practice in tractor work. This permits of making the forward end of the frame very narrow, thus making it possible to turn in a short radius in spite of the use of large

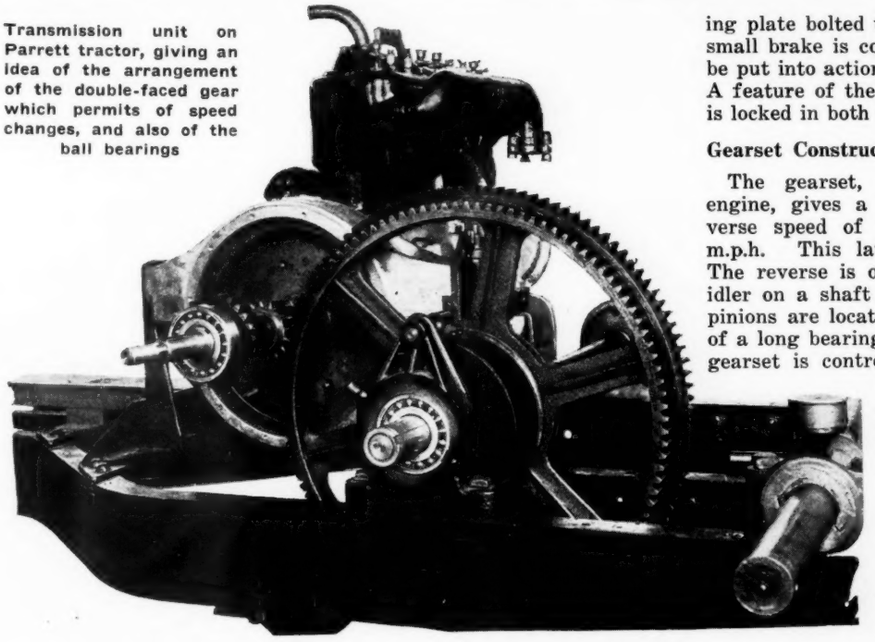
Details and Running Gear Layout of Parrett Tractor



A section through the clutch, change gear and final drive to rear wheel, illustrating the method of operating the clutch by means of a rod extending through the hollow pinion shaft and showing the belt pulley on this shaft. Note the ball bearings on both shafts of the transmission



Left—General plan of chassis, showing the small width of the frame in front, which permits of turning in a short radius; the swiveled arrangement of the front axle and the layout of the steering gear and of the frame members. Right—Kerosene-burning attachment, consisting of a vaporizer casting between carbureter and inlet manifold and an air heater on the exhaust pipe



Transmission unit on Parrett tractor, giving an idea of the arrangement of the double-faced gear which permits of speed changes, and also of the ball bearings

front wheels, and it also permits of the use of straight-toothed wheels exclusively in the transmission of the power from the engine to the rear wheel. Another feature of design resulting from the desire to obtain a short turning radius is the location of the radiator with its plane parallel to the axis of the tractor. There is a further advantage in this arrangement of the radiator in that it makes the front wheels clearly visible to the operator. The radiator, which is of the Perfex honeycomb type and has a water capacity of 5 gal., is mounted on a slab of wood supported on the steel frame at its ends, so as to minimize the vibration. It has the fan placed on one side of it, inclosed by a protecting grating, and so mounted on a three-armed spider that it can be adjusted both laterally to increase or reduce the belt tension and axially to bring the belt pulleys in line. This fan is rotated in such a direction as to blow the air through the radiator, instead of sucking it through, it having been found that a higher efficiency is obtained in this way, the difference in the temperature of the cooling water being as much as 10 deg. It is this method of driving the fan which makes necessary the protecting grating, as without it cornstalks would be drawn into the fan and cause trouble. The fan is mounted on ball bearings and driven at a speed of 1500 r.p.m. from a pulley on the magneto driving shaft of the engine.

Three-Plate Clutch Used

The clutch is of the three-plate type, consisting of two clamping plates which constitute the driven member and a central punched steel plate which has an asbestos facing on both sides and is driven from the engine flywheel through four integral lugs engaging into slots milled on the flywheel rim. Guiding pins are riveted into one of the clamping plates and extend through holes in the other plate. The former plate has its hub formed with clutch jaws which engage with similar jaws on a hollow driving shaft. This latter is cut out with integral keys on its outer surface, on which the two driving pinions for the different speeds slide. To the end of the hollow shaft is keyed the belt pulley. Through the hollow shaft extends a solid shaft by means of which the clutch is engaged. At the outer end of this solid shaft is carried a bracket to which are pivoted a pair of bell cranks. A sliding cone provided with a shifting collar may be forced between the long arms of these bell cranks, with the result that pressure is exerted on the central solid shaft in one direction and on the hollow shaft in the opposite direction, whereby the clutch members are pressed into engagement. This compound shaft, which carries the driving pinions and the belt pulley, is supported by two S.K.F. self-aligning ball bearings, one being a pilot bearing located in the bore of the flywheel web and the other a comparatively large bearing in a supporting plate bolted to the outer face of the gear case. A small brake is combined with the clutch cone and may be put into action by drawing the cone all the way out. A feature of the clutch construction is that the clutch is locked in both the in and the out position.

Gearset Construction

The gearset, which is located adjacent to the engine, gives a plowing speed of 2⅜ m.p.h., a reverse speed of 1.8 m.p.h., and a road speed of 4 m.p.h. This latter speed is also used for disking. The reverse is obtained by means of a double pinion idler on a shaft carried in bronze bearings. The two pinions are located both close to and on opposite sides of a long bearing, hence they are well supported. The gearset is controlled selectively by means of a lever having a motion in a transverse plane. The high and low gear are on one sliding bar and the reverse on another. The two pinions on the hollow splined shaft, as well as one of the pinions of the reverse idler, can be made to mesh with what is known as a double-faced spur gear. This is really a single gear wheel, having a single hub and set of spokes, but two different gear crowns of slightly different diameter. It may be pointed out here that the total reduction from engine shaft to driving wheel is 62.5:1 for the low gear and 43.5:1 for the high gear. The normal engine speed is 900 r.p.m.

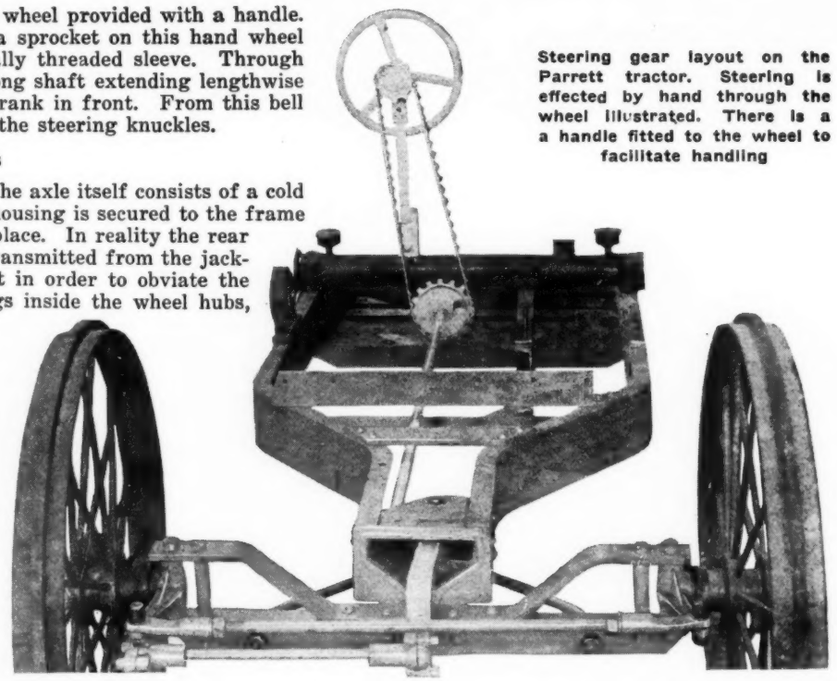
The double-faced gear is bolted to the differential gear on the jackshaft, which latter is supported on the frame side members by means of S.K.F. self-aligning ball bearings, 5.3 in. in diameter, located in brackets secured to the top of the frame channels. The differential gear is of conventional construction, being of the bevel pinion type, with four pinions. A brake drum is cast on the spokes of the double-faced gear. One feature of the differential gear that deserves mention is the very liberal bearing surface provided to take up end thrust on the side gears.

A single shaft extends the whole length of the jackshaft. One of the side gears of the differential is keyed to a sleeve which in turn is keyed to the jackshaft, while the other side gear of the dfferential is keyed to a sleeve free upon the jackshaft. This latter sleeve does not bear upon the jackshaft directly, but is provided with long bushings at both ends, One of the bull pinions is keyed to the jackshaft and the other to the sleeve which is free upon the jackshaft. In addition to the two S.K.F. bearings at the ends of this jackshaft there is a babbitt bearing in the housing on the inner side of the differential, so that the jackshaft is very rigidly supported.

The frame members are composed of 7-in. bridge steel channels weighing 9¾ lb. per foot. The two side members of each frame are duplicates, which facilitates their manufacture. They are connected at the forward end by means of a steel casting which is pivoted to the front axle. The frame is 46 in. wide in the rear, but only 14 in. in front, which permits of a wide steering lock, and the tractor can be turned in a circle of 22 ft. outside diameter. There are four angle iron cross members, in addition to which there is a cross bar of ⅝-in. strap steel at the rear. A steel plate of ⅛-in. thickness serves a footboard, and extends from the extreme rear of the frame forward for a distance of 34 in. Four floorboards are placed on top of this steel plate, however, so as to prevent slipping of the foot and also to give a more comfortable footing. A regular spring plow seat is provided and is supported by means of a lug secured to one of the frame sides.

The front axle is built up of one angle iron and one strap iron member, and the steering knuckles, which are of the automobile type, are placed directly between these members. A steel casting is riveted to the center of the front axle and serves for a pivot block. Through it extends a pivot bolt which is fastened into the front cross member of the frame as well as another cross member some distance back. Brace rods secured to the front axle and to the rear end of the pivot bolt give the axle stability in a horizontal plane.

Steering is effected by means of a hand wheel provided with a handle. A conveyor type of chain connects from a sprocket on this hand wheel to another sprocket secured to an internally threaded sleeve. Through this sleeve passes the threaded end of a long shaft extending lengthwise of the chassis and connected with a bell crank in front. From this bell crank there is a link connection to one of the steering knuckles.



Steering gear layout on the Parrett tractor. Steering is effected by hand through the wheel illustrated. There is a a handle fitted to the wheel to facilitate handling

Rear Axle Embodies Interesting Features

A cast-iron rear axle housing is used. The axle itself consists of a cold rolled steel bar 2⅝ in. in diameter. The housing is secured to the frame by means of bolts which are babbitted in place. In reality the rear axle is a dead axle, in that the power is transmitted from the jackshaft directly to the driving wheels. But in order to obviate the necessity of having the rear axle bearings inside the wheel hubs, where they could not be made as long as desirable, the axle is arranged so as to turn in two babbitted bearings, 10 in. long each, in the axle housing. A grease cup is provided for each of these bearings. In driving straight ahead the axle will turn in the bearings of the axle housing and there will be no rotation of the wheels on the axle. Of course, in turning around a corner one of the wheels will have to turn relative to the axle, and to permit of this, one wheel is made free on the axle while the other is secured to it. This motion of the wheel on the axle in turning corners is small as compared with the motion of the axle in the bearings of the axle housing, and the life of the wheel bearings should be comparatively long. However, in order to further reduce the wear of the bearings in the wheel hubs the two driving wheels are made interchangeable, so that first one and then the other can be made free upon the axle.

The transmission case is located on the left-hand side of the frame and is supported on the outside by the frame side member, in front by a cross member and on the inside by a channel extending between cross members. There is a sheet metal housing below the transmission case in which a bath of oil is maintained.

Rear Wheels 10 in. Wide

The front wheels are 46 in. in diameter and have a 4-in. rim, this being said to be the largest diameter front wheels in use on tractors of this power. The rear wheels are 5 ft. in diameter and have a 10-in. width of rim. Square skid rings 1-in. wide are shrunk on to the front tires. The bull rings are piloted on the hubs of the rear wheels and are connected by three driving straps to the rims. The engine is protected by a hood of which the sides are permanent, whereas the top portion is hinged at the center and may be raised to give access to the engine and change gear. This hinged portion is held down by hood fasteners of the spring type.

For starting the engine use is made of gasoline, which is carried in a 3-gal. tank. The main fuel supply, which consists of kerosene, is carried in an 18-gal. tank.

In addition to the clutch lever, gear lever, brake pedal, and throttle rod and control mechanism comprises a spark rod which retards the spark when pushed forward and in its extreme forward position short circuits the magneto so as to stop the engine.

General Specifications

The Parret tractor weighs 5200 lb. and develops 12 hp. on the drawbar and 25 hp. on the brake at 900 r.p.m. The belt pulley is 12 in. in diameter and has a 7-in. face. The wheelbase is 92 in., the width 72 in. and the overall length 144 in. What may be described as the driver's compartment is inclosed on both sides by upright steel plates secured to the frame side members and the dashboard back of the engine, and to these plates are secured mudguards over the wheels and protecting guard plates are placed over the bull rings and pinions.

An interesting feature of the tractor is that it is self-steering in plowing. Two of the wheels run in the furrow, and once the tractor has been brought into the right position the driver is entirely relieved of the duty of steering, so that in cold weather he can walk beside the tractor to keep warm. The draft bar is secured to the center of the frame, hence there is no side draft. Such side draft is objectionable because it creates side thrust on the bearings and makes the tractor hard to steer.

The Rôle of Vanadium in Steel

IN a paper read before the American Society for Testing Materials, G. L. Norris, metallurgist of the American Vanadium Company of Pittsburgh, combated the theory that vanadium in steel acts chiefly or exclusively as a scavenger. It is true that vanadium oxidizes readily and will combine with nitrogen, yet, according to Mr. Norris, its value as a scavenger is nil. The effects of vanadium on steels are due entirely to its presence in the steel as an alloying element, and its influence on the other constituents with which it is in combination. When added to steel it is found in both the main constituents, ferrite and pearlite, but principally in the latter. Only a few hundredths of one per cent of the vanadium combines with the ferrite. This minute amount, however, appears to increase the strength, toughness, hardness and resistance to abrasion of the ferrite. Nearly all the vanadium, however, is found in the pearlite, in chemical combination with the cementite, as a compound carbide of vanadium and iron in the case of ternary steel, and as more complex carbides in the case of quaternary steels.

Replaces the Iron Element

Vanadium replaces the iron in the cementite or the carbide by increasing amounts until finally, when the percentage of vanadium is about 5 per cent, all the iron has been replaced by the vanadium. The vanadium-containing cementite is not as mobile as ordinary cementite and consequently does not segregate into as large masses, but occurs in relatively minute particles and, therefore, is more uniformly distributed. It does not, consequently, readily occur as lamellar or thin plates in the pearlite, but in a granular or sorbitic condition. This strong tendency of vanadium to form sorbitic and even troostitic pearlite, is doubtless one of the reasons for the mechanical superiority of steels containing vanadium, not only statically, but dynamically.

How Farmers View Tractors*

Investigations of Department of Agriculture Disclose Many Troubles—Medium Size Farms Growing Larger—Better Reliability Wanted

By Arnold P. Yerkes
Assistant Agriculturist, U. S. Department of Agriculture

THERE are two distinct angles from which the tractor is usually considered, one the manufacturer's, the other the farmer's viewpoint. The problems of the manufacturer are largely those which must be dealt with by the engineer and sales manager, while those of the farmer are for the most part problems in farm management, dealing with the practical application of the tractor to farm operations, and its economic value. In other words, farm management's and the farmer's viewpoint are the same. There are many farm-management problems involved in the utilization of the tractor which should be of interest to the tractor engineer and designer, as they have an important bearing upon the trend of the industry.

A subject which is of the utmost importance from a farm-management standpoint, and which should be of interest to the engineer is that relating to the size of farm on which tractors can be used profitably. Many people appear to be under the impression that the farms in this country are growing smaller each year, and that the demand for small tractors should therefore increase. The foundation for this belief, in many cases, is the figures given in the U. S. census showing the total number of farms in the country at different dates. "Figures don't lie," but they are easily misinterpreted. In this case they have not been carefully analyzed. While the figures showing the total number of farms do indicate a heavy increase in the number of farms of less than 100 acres, many of these are small truck farms of less than twenty acres, and need not be considered as a tractor market. Most of the others are in sections where tractor sales, for several years, at least, will be negligible. In the States which are ordinarily considered as the principal tractor market both the number and percentage of farms of from 50 to 99 acres decreased considerably from 1900 to 1910, while the number and percentage of farms ranging from 100 acres up increased.

Labor-Saving Machinery Increases Size of Farms

The introduction of labor-saving farm machines has a tendency, other things remaining equal, to increase the size of our farms. This has always been true in the past and will undoubtedly be true in the future. Our investigations show that the tractor is having a decided influence in this direction. A large percentage of farmers, after purchasing a tractor, increase the size of their farms considerably.

Farm-management studies have shown clearly that there is a sound economic reason for the decrease in both number and percentage of farms between 20 and 99 acres in the Middle Western States, while the number and percentage of farms both larger and smaller increased. The reason is that farms from 20 to 99 acres in this section are of inefficient size; they are too small to make efficient units for the type of farming commonly followed in that section, hence some have been combined to make farms of a profitable size, while others near cities or convenient to transportation have been divided into truck farms.

Most tractor engineers desire to design a machine to meet the greatest demand. From the accompanying figures he can judge for himself which sizes of farms will probably be the heaviest users of tractors. (It must be remembered that the total acreage of any group of farms of a similar type is likely to be a better guide of their buying capacity than their number.)

From these figures it will be seen that while farms of less than 100 acres represent approximately one-third of the total number of farms in these States, they contain only 8.7 per cent of the total farm acreage. Their tractor capacity will probably correspond very closely with the latter figure. Farms of from 100 to 499 acres represent 65.6 per cent of the total farm acreage, and it seems reasonable to believe that in this group will be the bulk of tractor sales. The farms of 500 acres and over, while only 5.5 per cent of the total number of farms, contain 25.7 per cent of the farm land, and each farm should represent a potential tractor market.

SIZE OF FARMS IN ILLINOIS, IOWA, MISSOURI, KANSAS, NEBRASKA, NORTH AND SOUTH DAKOTA

Size of Farm	Percentage of Total Number of Farms, 1910	Percentage of Total Farm Acreage, 1910
Under 20 acres	5.6	0 3
20 to 49 acres	9.4	1.6
50 to 99 acres	17.7	6 8
100 to 174 acres	32.6	23.6
175 to 499 acres	29.2	42 0
500 to 999 acres	4.4	15 2
1000 acres and over	1.1	10.5
	100.0	100.0

*Paper read at meeting held at Fremont, Neb., Aug. 9.

Size of Tractor Best Suited for Common Use

Closely related to the size of farm is the size of tractor best suited for general use. The Office of Farm Management has given careful consideration to this point and has made inquiry of thousands of experienced owners. The results of such studies were published a little over a year ago, and I may state that the thousands of detailed reports received from users since that time corroborate the facts as published. Judging by the experience of these men the three and four-plow outfits are the most efficient sizes, all things considered. A very large percentage of men who have used two-plow machines state they are too small, and recommend those capable of handling three or four plows. Of the large number of men who are using three-plow outfits none advise anything smaller, although several recommend the four-plow rigs. At the same time a considerable percentage of men who have used six, eight, and ten-plow tractors, principally owners of exceptionally large farms, state that the medium sized outfits would be more economical. There are, of course, a number of factors which influence the size of tractor best suited to the individual farm, but the indications are that a four-plow machine will most nearly meet the requirements on the greatest number of farms using tractors.

Belt work is the largest item which can be included under one head; this represents, on an average, about 50 per cent of the work which the tractor generally does on farms. This, of course, includes many different kinds of work, but usually there are only two limiting factors involved; one is the amount of power available for the heavier operations such as cutting ensilage or running a separator; the other is the question of economy in doing the lighter jobs. Aside from these the nature of the belt work is immaterial; the tractor will take care of it.

Plowing, of course, is essential, also work in preparing the land for seeding, such as disking, harrowing, packing and pulverizing. These are too familiar to warrant discussion.

The problem of cultivating is apparently in a fair way to be solved by the production of low-priced gasoline-driven cultivators, which are also capable of taking care of light two-horse operations, such as operating a corn-planter and a

grain-drill. Aside from the quality of the work and ease of manipulation, these do away with the necessity for moving a heavy plowing tractor over soft ground in order to perform light work, and would thus seem to justify their purchase for farms where any considerable amount of cultivating was required. They should also help out with the lighter belt work.

Mowing with the common type of horse mower, while possible, is rather an awkward and unsatisfactory operation, and usually increases rather than decreases the man labor required per acre. The same is true with binding. However, a heading device is on the market which is mounted on the tractor's own frame, permitting absolute freedom in operation and control by one man. It is certainly not expecting too much to look for a similar solution of the binding and mowing operations, and if a grain binder, then why not a corn binder? Nor does there seem to be reason for doubting that both side-delivery and sweep rakes could be attached in somewhat the same manner, thus making the tractor a valuable addition to the farm equipment in haying season, when it must now stand idle or be utilized very inefficiently.

Tractor for Hauling Work

For hauling, the tractor, unless it is a very small one, is practicable only for heavy loads. This means either special wagons or a wagon train. The latter is unsatisfactory under most conditions because of its unwieldiness and troubles caused by inability to back. In many places unloading facilities prevent the use of the wagon train. The truck or automobile trailer will probably be more useful and practicable in most cases, while in others the tractor will be satisfactory for this work.

For hauling manure only small outfits are practicable; the larger machines are not loaded economically. There would seem to be no reason, however, why special manure spreaders of large capacity should not be made for use with tractors.

This completes the list of the principal farm operations which the tractor reasonably should be expected to perform. In utilizing it as an all-around source of farm power the important consideration would seem to be to give it a fair chance by furnishing equipment designed for use with a tractor and not attempt to compel it to operate with equipment designed for use with horses. The two sources of power are entirely dissimilar. Most farm machines are operated with a rotary motion of some parts. When horses are employed this rotary motion must be obtained by means of gears driven by friction wheels in contact with the ground. The horse is also capable of moving sidewise as well as forward or backward, hence it is no handicap to operate a machine drawn behind him. The tractor, on the other hand, can furnish power with a rotary motion without the aid of the friction wheels, and while it cannot move sidewise it moves backward or forward easily, giving splendid control over any machine mounted on its own frame, but is distinctly handicapped by a machine drawn behind it.

Extracts from letters sent to the S. A. E. by tractor manufacturers have mentioned the subject of service in the following terms:

The first reads: "We are particularly interested in the tractor service problem. This represents the greatest problem to be met in the more rapid development of the tractor industry."

The other states: "The most serious subjects for discussion in the tractor business are the service end of the proposition and the relationship which service will bear to the standardization of tractor parts, or vice versa."

Standardization Engineer's Problem

The problem of standardization must be dealt with principally by the engineer. While this is a matter in which the farmer should be greatly interested, since it is to his advantage as well as the manufacturer's, it is one concerning which he is generally uninformed. It would seem that the desired results along this line must be achieved through cooperation on the part of the manufacturers and education of the farmer regarding the subject.

The service problem, however, is one in which both manufacturer and farmer are vitally interested, and is of sufficient importance to deserve the entire space of this discussion. The business of both the manufacturer and farmer is suffering because of it, and must continue to suffer if it is not solved. The quotations given indicate that the manufacturers realize the importance of the subject, and the following extract from a letter received last week by the Office of Farm Management shows that the farmer also realizes its importance. It likewise indicates very clearly how both the manufacturer and farmer suffer because of this trouble. I may say that the letter was picked at random to illustrate this point; we receive many similar ones daily. The letter, with some grammatical changes, reads as follows:

"This machine was the cause of my losing my entire crop the year I bought it, as I didn't have any other power to put it in at the proper time. When I bought this machine I had to pay every cent on it before I got to see the machine. After the company got my money they told me to communicate with their agents in St. Louis thereafter when I was in trouble. I wrote to these people; they told me I was not entitled to any information as I had not bought the machine from them. The company had my money and I had their scrap. The company has offered to take this old machine as part payment on the new one, provided I pay for the new one at the factory, which I shall never do. If I ever buy another machine it will be right here on the farm doing the work. I don't know any one in this neighborhood who has a machine for farm purposes, as every one was watching me and I had too much trouble to encourage anybody."

Question of Delays

Of course, this is only one side of the story in a particular case, but it serves to illustrate the point. Many farmers complain of delays at critical times in the working season in obtaining repair parts. One writes:

"I lost more time waiting for repairs this spring than it took to plow sixty acres. Then come those high-priced repair, telephone and express bills."

Many others give as a reason for selecting some particular make of tractor the fact that the factory was located nearby, or that repair parts could be obtained readily at some local agency. I mention this merely to show that in many cases the question of service is considered by the farmer before

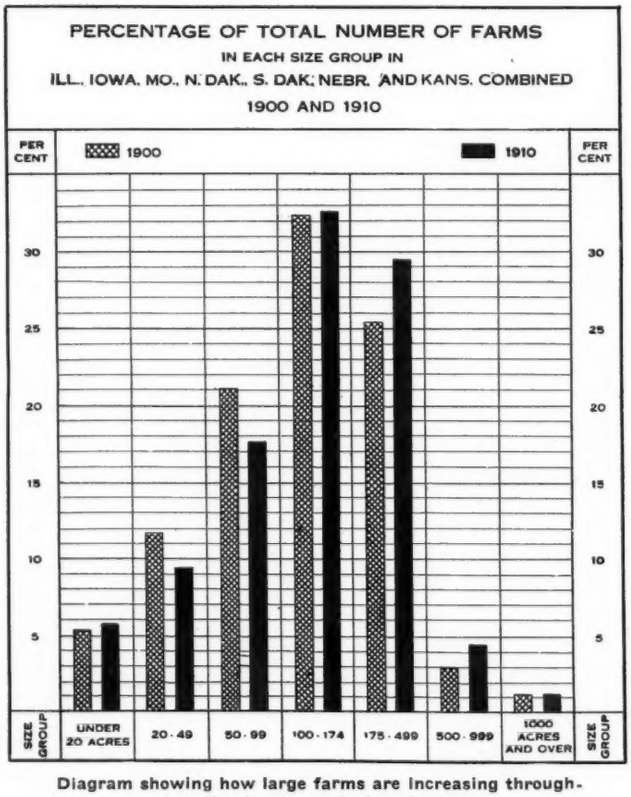


Diagram showing how large farms are increasing throughout the larger agricultural states

the purchase is made and is, therefore, a strong factor in determining the particular make of outfit which he will buy.

So much for a brief statement of the problem as it exists. The statement of the solution is not such an easy matter. While I had no trouble whatever in finding plenty of letters to illustrate the lack of satisfactory service, I had difficulty in finding any mentioning its existence, which goes to show how ready the average man is to complain and how backward with his commendation. Finally, however, I found the following:

"I cannot report that my experience has been satisfactory, for the reason that there have been too many annoyances and delays in the operation of the tractor on account of defects appearing which brought about many delays and very much expense.

"My understanding with the company when I purchased the tractor was that they would furnish a man to rectify any trouble that would appear in the operation of the tractor. The consequence was that for 6 months I had them sending a man to look after the tractor two or three times a month. Finally after plowing about 200 acres they furnished complete repairs for everything that required replacing. In order to give you an idea as to what this amounted to: They gave me a credit memo for the items, aggregating over $400. Considering that I originally paid $1,000 for the tractor, this explanation will indicate to you the continued annoyance and trouble I had with the operation of this tractor. The company, of course, took the position that the man operating the tractor was not conversant with its operation—consequently, it resulted in wearing out parts that could have been avoided if he had been more familiar with his duties. However, right here I wish to state that the man I employed was very much above the average man that a farmer can obtain to operate a tractor.

. . . . . .

"Wish it distinctly understood that the company treated me fine, and gave assistance in every way to take care of every trouble that appeared, and finally replaced all worn-out parts with new repairs without charge."

This shows the nature of the service some companies are furnishing; certainly they did all or more than any one has a right to expect, but it is not really satisfactory to either themselves or the farmer, as it represents heavy expense to both.

Farmer Wants Perfect Service

So far as the farmer is concerned the only "service" he really cares about is that received from the machine itself, in other words, anything less than perfect performance on the part of the outfit is bound to be unsatisfactory to him. In the absence of this he is, of course, interested in having first-class "service" from the manufacturer, in order to reduce delays to a minimum.

It is obvious that a really fool-proof and absolutely reliable tractor would solve the difficulty, but, unfortunately, the manufacturers and their engineers while working toward this end have not yet attained it.

Perfect "service" from an imperfect machine can scarcely be expected, but the nearest possible approach to it will be attained when the outfit is handled by a first-class operator. To state it another way, the more proficient the operator the better the performance of the machine and the less the service which is demanded of the manufacturer. Is it not logical then to believe that the solution of the problem must be brought about largely through the education of the farmer in the proper care and operation of the tractor?

The hiring of competent operators is frequently suggested, but most farmers feel that they cannot afford to pay the prices such operators rightfully expect. It would therefore be necessary to convince the farmers that it would pay them to hire such men, so why not convince them that the proper thing to do is for either their sons or themselves to spend a little time and a few dollars in acquiring a training which will enable them to save many times its cost in both time and money by handling the tractor intelligently and economically, thus avoiding expensive delays?

The hired operator is an uncertain proposition for the farmer in any event, as it is extremely difficult to ascertain the qualifications of an applicant for the job. Many cases have occurred where men represented themselves as expert operators and demanded high wages, yet were utterly incompetent and incurred heavy repair bills by their inefficient operation of the outfit.

It would appear that some manufacturers have felt that it was a discredit to their tractor to admit that a man need spend any time in learning to operate and care for it. Extravagant claims that "anybody can run it" have resulted in many farmers feeling that it was an admission of a lack of even ordinary mechanical ability on their part to require instruction in the operation of a tractor or to ask for advice concerning it. This fact has been largely responsible for the need of so much service being required after machines have been in operation a short time.

Actual experience in thousands of cases has shown so conclusively that running a tractor is not a job for either a boy or an inexperienced man that it should be unnecessary at this stage of tractor development to have to take time to contradict the old statement that "any boy can run it." Every experienced tractor manufacturer knows better, and the new ones who still make such claims not only show their lack of experience but are paving the way for service troubles at a later date by misleading the purchaser and preventing him from taking the trouble to inform himself fully regarding the operation of the outfit.

The tractor is strictly a business proposition with the farmer. He cannot afford to risk delays with his work at critical seasons when a small amount of time and money spent in learning how to run the outfit will give a strong guarantee that such delays will be avoided.

From both the farmer's and manufacturer's viewpoint, therefore, the best way of solving the service problem would seem to be through its elimination by putting the farmers in a position to get a higher degree of service from the machines and requiring less from the manufacturer and his agents.

—

Greece Offers Trade Opportunities

GREECE is expected to be a fertile field for the sale of American automobiles after the war. It is felt that the use of the automobile there is still in its infancy. Large numbers of shipowners have suddenly become wealthy, owing to successful operations in the Balkan and present wars. They desire automobiles for convenience and in some cases have advertised the fact that they are able to pay the very high prices demanded for cars and for gasoline. During the last year gasoline has frequently sold at $2, $2.50 and $3 per gallon. The comparative lightness of the average American product makes such machines peculiarly suitable to the rough roads of the greater part of Greece. Whenever there is a choice between such automobiles and European models, the American product is bought in nine cases out of ten, other things being equal.

After the entry of Italy into the war the exports of automobiles from Germany and Austria were automatically cut off; and as the allied governments had need in most cases of the entire output of factories for war purposes, the American manufacturer would have had a fair monopoly of the local market but for the restrictions of the Allies upon the imports of automobiles into Greece to Austria and Bulgaria.

In 1912 the value of automobiles imported into Greece was $51,151, and in 1913, $62,907. In 1914 and 1915 the value was as follows:

Countries of Origin	1914	1915
France	$34,875	$17,794
United States	23,266	32,119
England	16,474	12,590
Italy	14,474	12,927
Austria	7,720	2,026
Switzerland	5,790	....
Germany	3,088	2,026
Belgium	965	....
Total	106,652	79,482

Truck imports in 1915 amounted to $2,895, these being imported from England and France. Figures for 1916 are available only for the first 9 months, and even for this period are thought to be incomplete. According to these figures, the imports from January to September, 1916, amounted to $126,605, and the imports of spare parts were $6,295.

Tractors Often Overdriven*

Farmers Give New Tractors Far Rougher Treatment Than New Automobiles—Service Must "Begin at Home"

By S. C. Turkenkoph

Sales Manager, Tractor Branch, Moline Plow Co., Moline, Ill.

TRACTOR service, like charity, should begin at home. By this statement we mean that it is impossible for any manufacturer or dealer to render efficient tractor service, no matter how excellent an organization he may have, without intelligent co-operation from the farmer owner.

Few farmers or dealers realize the amount of work the tractor engine does every day it is used. For comparison's sake we will say that the average tractor engine works at 75 per cent of its total efficiency. The engine in an automobile works at only 25 per cent of its total efficiency. On many tractors the engine makes 25,000 revolutions per mile to 2500 revolutions that are made by the engine in an automobile.

It has been said that one hundred working days represent the maximum time that a tractor will be used per season. In one hundred working days of 10 hr. each the engine in a tractor turns over an equivalent to the revolutions of an engine in an automobile driving 25,000 miles. These figures, we believe, prove beyond any question that timely and proper service must be rendered by all legitimate tractor manufacturers and their dealers.

More Attention Needed at First

We are familiar with the amount of repairing necessary to maintain an automobile for a distance of 25,000 miles. Will not the tractor, in the same time, require as much, if not more, repairing than an automobile? It is working at 75 per cent of its total efficiency, while the automobile is only working at 25 per cent. If this is true, tractor dealers must maintain efficient tractor service organizations that not only are able to do any mechanical work that may be necessary on tractors in use by their customers, but also possess sufficient knowledge, or tractor education, to enable them to impart to the owners complete knowledge of tractor care and operation. I realize that this means much hard work, but, on account of conditions, and of the fact that the tractor is practically a new invention, we can see no other way by which the farmer can have service.

It is a well-known fact that an automobile should and does require more attention during the first 500 miles that it is in use than it does for the next three or four thousand. This is particularly true of a tractor. The tractor covers in the first two or three days it is in use what is equivalent to 500 miles' travel of the automobile. It must have careful and exact attention over that period.

Overdriving New Tractors

When a tractor is first put in service the conditions are entirely different from those present when an automobile is first put in service. In many cases the automobile is sold to a man who has never driven one. He naturally drives slowly and carefully until he has learned to operate. During this period his engine is "wearing in." Also because he drives so carefully he covers but a few miles per day, and the engine has a chance to "cool off"—recuperate as it were. How about the tractor? It is delivered to the farmer who has told John, Bill and Jim that he has purchased a brand new tractor, and that the man is bringing it out to start plowing. All the friends and the family gather around to see her go. Either the farmer, his son or the dealer's operator gets on the machine, and the farmer says "drop her in." The operator drops down to 4 or 5 in. in depth. Someone asks the question, "Won't she go deeper than that?" Down goes the plow another 2 in. Finally, after the first few minutes, the tractor is lunging across the field at its maximum speed, the plows down to the extreme depth, with its tongue hanging out gasping for breath, if that were possible. It must go ahead and work without relief or rest for 10 hr., or an equivalent of 250 miles of car driving. It it does not do this then it is no good, and the farmer is ready to take it back to the dealer.

Service, like charity, must begin at home. The dealer must be able to instruct properly the owner to handle the tractor, teaching him at the very beginning why to expect only the reasonable things, and to treat the machine as kindly as he would treat its equivalent in fine horses, or the real cash, if he were going down a back street in some strange town.

As every hour the tractor is driven means driving an automobile 25 miles to a garage or service station to see what is the matter with it, we can readily see how it is impossible or impractical for any dealer to render efficient service on a tractor that is in use. How long will a connecting-rod bearing last in a racing engine or one working under heavy duty after it has developed a knock? How is it possible for the dealer, or his man, to be always on hand to place the "stitch in time" that will save the 9 hours' work that the farmer is sure to lose before anyone from the dealer's establishment can be on hand and make repairs? It is all the more impossible for the manufacturer to render mechanical service that will be productive of satisfactory tractor operation. Of course, wherever a machine has been permitted to reach the point where it breaks down, and must have new parts installed to put in working condition, the manufacturer or the dealer can take care of the case after a reasonable delay, but our experience has taught us that it is not repairing break-downs that constitutes real service; it is the odds and ends of upkeep and care that enable tractors to work continuously and give entire satisfaction without being laid up for repairs.

Must Educate Farmer

It can easily be seen that not even the dealer, much less the manufacturer, can be present to render this sort of service. Then how is service to be given? The farmer must be so well versed in tractor operation and repairing that he is able to keep his machine in condition, devoid of trouble by the "stitch in time" which is the basis of all real service. We think this sort of service can only be obtained by the manufacturers teaching their dealers all the points of tractor operation and repair, the dealers, in turn, teaching the farmers.

Service to the farmer must be the watchword of all tractor manufacturers and their dealers. Great stress must be laid on the necessity of teaching the owners how to successfully maintain and operate the tractors purchased.

There is another indirect angle that has bearing on efficient service. That is the tendency of all salesmen, and, I might add, of a few manufacturers, to over-sell their machines. Of course, I cannot severely censure the manufacturers' inclination to want to oversell. Where is the mother whose child is not the sweetest, dearest one living? Overselling as the result of extravagant claims is probably one of the chief causes of dissatisfaction. It is the natural inclination of the salesman to follow the easiest course, to float downstream. He finds out what the farmer wants the trac-

*Paper read at Fremont meeting of Society of Automotive Engineers Aug. 9.

tor to do and tells him that his tractor will do it. But when the farmer gets the machine and finds out that it is not what the salesman led him to believe he is somewhat disgruntled and begins to pick it to pieces. An effort by all manufacturers to hold the claims made in advertising matter or by their travelers to a reasonable point or below what the tractor will really do will not affect sales, and will still permit every tractor to give better service.

We should all lend our every effort to hold our advertising managers, our travelers and our dealers in check. Avoid making extravagant claims that cannot be proved in actual work, and which, in most cases, are absolutely unnecessary.

Just a word about standardization and we are through. It would be an ideal condition to have all farms standardized, so that, if a man sent the specifications covering the farm he owns, all that we would need to do would be to fill them. Standardization would add greatly to the success of tractors, but we believe that before an attempt be made to standardize farms or standardize their owners, or, for that matter, standardize types and sizes of tractors, we should standardize some of the easier and important items, namely, belt speeds, horsepower and belt-power ratings, and other similar things that are necessary to produce better service to the purchaser.

We are in an age where co-operation will be productive of monetary gain to all who are engaged in the tractor industry. Good service to users will increase the demand for our product. It will permit the farmer to go to a dealer and say, "My neighbors own four or five different makes of tractors, and they all give good service. I don't know which one I like best."

We should all work together and exchange service ideas that have been found to be practical. This can but lead to better business and less "grief" to all.

Free service in all lines is at its zenith. We predict within a few years all tractor makers will be drawing in, giving less free service, and teaching the purchaser that at least a part of the responsibility is his own.

Tractor service, like charity, must begin at home. We must teach the farmer to take care of his own machine if we want him to have real service.

Free Service Often Abused

By Fred P. Steele

Manager Tractor Department, Lyons Atlas Co.

AS a preface to this short talk, I wish to say that, having been in the tractor business for less than a year, I do not believe myself an expert on what tractor service should be. Having been in the automobile business since its infancy, however, and seeing service rendered from the three sides, manufacturer, dealer and owner, I do know, as all present here know, who have been interested in the automobile business, that one of the reasons for so many failures among manufacturers and distributors, as well as among the small dealers, was due to the abuse of the word "service." Therefore, it is my presumption that we wish to avoid as many of these evils in the tractor industry as it is possible to do, and still give good, substantial service.

The word "service" has been much abused. Service does not mean giving something for nothing as so many farmers have been led to believe; it does mean, I believe, giving the maximum of care to our products in the hands of the ultimate consumer at as low a cost to him as possible. However, the manufacturer and dealer who employ men for this service are as much entitled to a legitimate profit on their time and trouble as they are to future profits (I say *future* profits advisedly) and as they are to profits on their original investment in grounds, buildings, machinery, and on other moneys expended.

Getting Much for Nothing

As a sample of what some farmers think (or want us to believe they think) the word "service" means, the following is a true statement concerning the owner of one of our Atlas tractors. This man has a farm ninety miles west of Chicago. He telephoned our plant at Indianapolis that he was in trouble. His tractor refused to run anywhere nearly satisfactory, and he must have a factory man at once, as he had only had the tractor a few weeks. We asked him his troubles, and he stated he did not know. He also asked us to send a cylinder-head gasket with this man. Now, this farmer had owned two other tractors previously, and still he stated he did not know the trouble. When our man arrived at his town with his kit of tools extra, he said, "Well, you won't have to go out to my place. All I wanted was that cylinder-head gasket, and I knew if I telephoned for a man you would get here quicker than the express." Under these conditions we sent this man a bill for our expert's traveling expenses, not his time, which we also really should have done, had this farmer refused to pay the bill, saying he had received this service free from the manufacturers of the two tractors he had owned.

It is hard to believe that he continually received such service free, but, if so, it is the evils caused by such ridiculous claims for service as this that must be remedied.

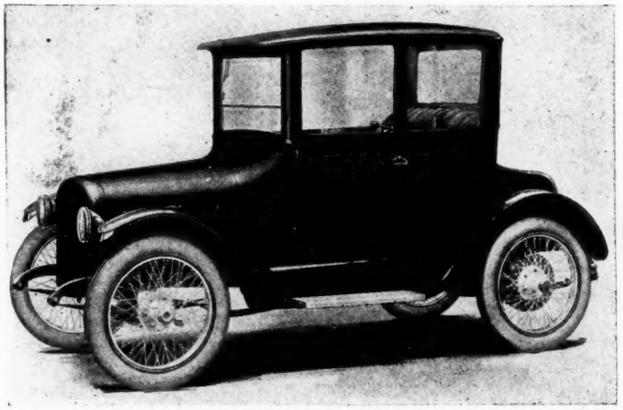
On the other hand, there is the irresponsible manufacturer, few perhaps, still he is here. This manufacturer promises anything and instructs his salesmen to promise anything both to the dealer and ultimate consumer, and forgets those promises immediately when his tractor is delivered and paid for.

The problem of irresponsible dealers is, perhaps, the hardest to which to find the solution. He will promise anything and everything, and when these promises cannot be fulfilled, he will blame their non-fulfillment on the manufacturer of the goods, who is not to blame, but who, in the end, will be blamed by the ultimate consumer.

The responsible manufacturer and dealer sits idly by for a time and sees the irresponsible dealer and manufacturer reap the early harvest. He of course will finally come into his own. In the meanwhile, however, the responsible manufacturers' and dealers' salesmen see the fly-by-night manufacturer and dealer doing a large business on promises that will soon be broken, and, in their anxiety to secure this business, they become over-enthusiastic, and will sometimes make very broad promises. These, however, are invariably lived up to by the responsible manufacturer or dealer whose salesmen make them, but at a tremendous cost that can be avoided if some means are adopted at the earliest possible moment.

—

Springfield Type Detroit Electric



A Detroit electric fitted with Springfield type body and a new shape of battery hood. This is the latest addition to the models being introduced by the Anderson Electric Car Co., Detroit, which sells for $1,975.

Three Buda Models for 1918

Engine Manufacturing Concern Will Produce Four Cylinder Models Only, Largely for Truck and Tractor Service—Oiling System a Feature

FOR 1918 the Buda Co., Harvey, Ill., has adopted a new policy with reference to the manufacture of Buda engines. The entire facilities of this corporation will be concentrated on practically three types of four-cylinder motors, namely: QU, 3¾ by 5½ in.; OU, 4⅛ by 4½ in.; TU, 4¼ by 5½ in.—all similar in appearance, only differing in cylinder bore.

The models HU, 4¼ by 5½, and YU, 4½ by 6 in., are strictly heavy duty types with full pressure lubrication through a drilled crankshaft, as illustrated in the photograph.

Heretofore the Buda Co. has manufactured a number of different types, including sixes, but by concentrating on the three models of four-cylinder engines in five sizes, it will be able to increase production and meet the demands for types which are required most. The Buda Co. is probably the first manufacturer of engines to take this step, and it is in line with Government policy to speed up production in every way possible.

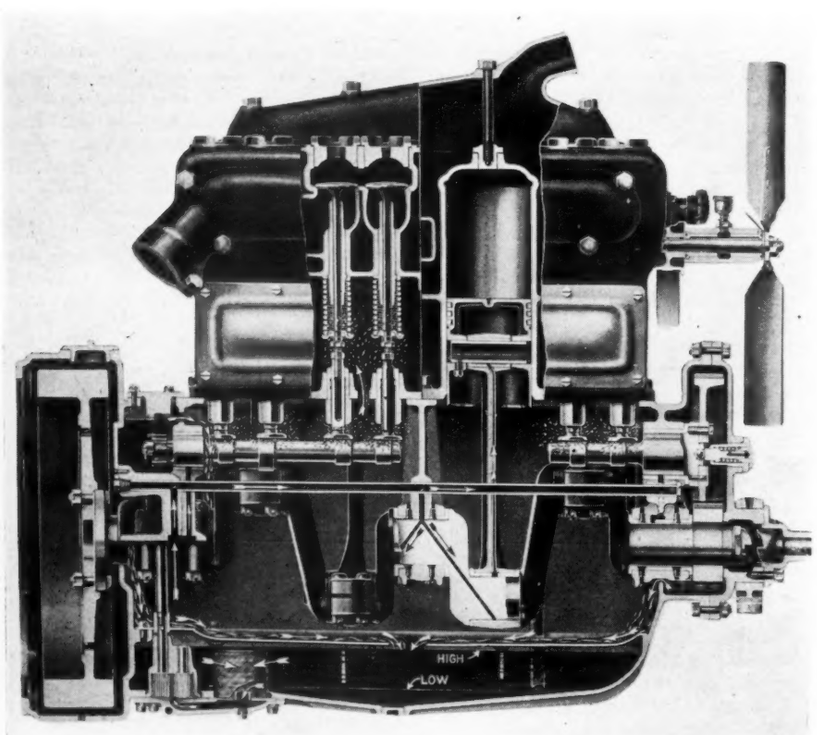
The accompanying horsepower chart shows the power curves of the engines on which it is proposed to concentrate. All are types especially suitable for truck and tractor work, and for truck service the motors are suitable for vehicles of from one up to perhaps seven tons capacity.

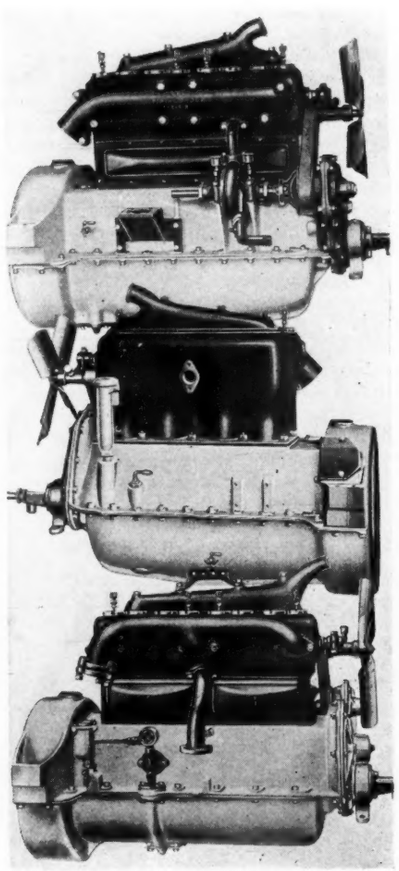
The horsepower chart shows the horsepower developed up to the maximum safe constant speed, which is 1000 ft. piston travel per minute. The torque characteristics of all these engines are said to make them specially suitable for heavy duty service.

These motors are all arranged to take any standard type of governor, the governor drive being attached to an extension of the vertical pump shaft. The Buda Co. does not furnish the drive, driving cable or governor proper, but only the governor or mounting to which the drive is easily attached. All motors are made with gray iron crankcase and oil pan, the bell housing being No. 3 S. A. E. standard. They are all three point, main frame suspension.

Lubrication System

Referring to the illustration of the full pressure lubrication system, used in HU and YU models, the oil is drawn from the lower reservoir through a fine screen, being delivered through a steel distributing tube extending horizontally the full length of the crankcase. Suitable passages connect with this tube, which carry the oil directly to each camshaft bearing, as well as to the main shaft bearings. From the main crankshaft bearings the oil is forced through the hollow crankshaft to each connecting-rod, whence it is forced through





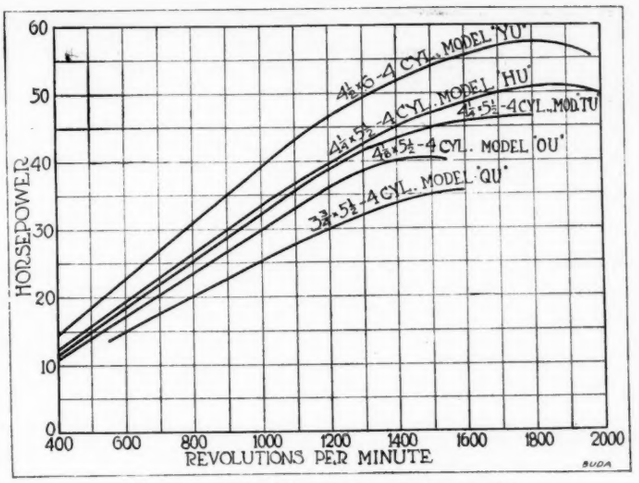
Above—Part-sectional view of Buda engine, showing details of oiling system. On the right, beginning at the top—Model YU, valve side; Model HU, off side; Model QU, OU or TU, valve side

tubes up the connecting-rod to the piston pins. Cylinder walls and pistons are lubricated by oil thrown from the end of the connecting-rod. A pressure of 40 lb. is carried on the oil at 1000 r.p.m., which pressure is maintained automatically. The pressure can, however, be regulated by a valve located in the line. Provision is made to connect a gage in the system, enabling the operator to know at all times the condition of his oiling system, since any obstruction or leak in the line is immediately indicated by the gage.

Timing-Gear Lubrication

The timing gears are lubricated from the pressure system, a constant level being maintained in the gear case by means of an over-flow leading to the reservoir. The valve stems and push rods being inclosed, are lubricated by oil vapor from the crankcase through holes drilled in the base of the cylinder.

The Buda Co. has one of the finest testing departments in the country. In this are installed approximately sixty Sprague electric dynamometers, and all motors are placed on dynamometers as soon as assembled, never being removed except for adjustments, until they are run in and ready for shipment.



Power curves of the various Buda engines

Chain Drive on Acason Ford Tractor Attachment

AN attachment for converting a Ford chassis into a tractor has been brought out by members of the Acason Truck organization of Detroit, who have recently formed the Acason Farm Tractor Co., Detroit. This tractor incorporates several distinctive features, particularly as regards the method of transmitting the drawbar pull and in the use of a chain-drive.

It will be noted that the drawbar attachment is at the center of the converted Ford chassis, thus having the effect of holding the front wheels on the ground. It is claimed that with the lighter type of tractors it is a common failing that the front wheels are lifted from the ground due to the forces of the drive and the drawbar pull. A study of the attachment shown herewith will bring out the fact that in pulling the trailer the front wheels are held on the ground by virtue of the fact that the drawbar attachment is forward of the rear wheels, which act as a pivot point upon the ground.

The drive is by chain with a pinion sprocket fitted to the ends of the ordinary Ford axle and a large ring sprocket connected to the drive wheel. The reduction between the sprocket and the drive wheel is 39 to 1. The starting shocks are claimed to be more easily absorbed by the use of the chain-drive, and it is claimed that the rear spring absorbs the starting torque.

The load is hauled by a steel chain which is attached to the center of the Ford chassis and carried over braces which extend downward from the attachment frame. This spring drive and spring pull are claimed to be exclusive and applications for patents have been filed.

The tractor is known as the Aca-tractor chain-driven unit, and the makers claim that the drive strain is distributed over several teeth in front and rear sprockets, so that breakage of a tooth in either does not put the machine out of commission. The chains used in the drive are the Diamond Roller type 1 by ⅝ by ⅝ in. This is a self-cleaning chain due to the fact that it operates around a very narrow angle on the sprocket. The Ford rear axle is strengthened by a channel beam to prevent danger of springing.

One of the advantages claimed for the unit is its short wheelbase. This is due to the fact that the drive wheels are placed in front of the Ford axle, and has the advantage of being able to make a short turn in plowing and other field operations.

Probably the greatest difficulty which Ford tractor attachments have had to contend with is in the supply of cooling water. The method used in the Aca-tractor to increase the radiator capacity is to mount above the engine a tank holding 11 gal., making a total of 16 gal. of water in circulation. Another provision made in meeting the troubles which beset the farm tractor is the use of the Bennett air cleaner. This is an air washing arrangement which is in common use on tractors.

By setting the drive wheels close to the frame, the front and rear wheels track in the furrow. This tends to reduce the pull in plowing. To attach the machine to the Ford chassis requires about 3 hr. No holes need be bored in the chassis and it is only necessary to put four clamps in place and a total of ten nuts. No changes are made in the mechanism of the Ford. With the Acason attachment a clear view of the implements is given while working in the field, and this is not the case where the body remains on the chassis. The standard attachment sells for $265 and a steel seat sells for $5 extra.

Mechanical Equivalent of Light

A BULLETIN on Luminous Radiation from a Black Body and the Mechanical Equivalent of Light has just been issued by the Bureau of Standards. W. W. Coblentz, associate physicist, and W. B. Emerson, laboratory assistant of the Bureau of Standards, are the authors. Copies of this bulletin can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

The Automobile and Automotive Industries

PUBLISHED WEEKLY

Vol. XXXVII Thursday, August 30, 1917 No. 9

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
231-241 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
Sydney Oxberry P. M. Heldt
J. Edward Schipper, Special Representative, Detroit

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address ---------- Autoland, New York
Long Distance Telephone ---------- 2046 Bryant, New York

SUBSCRIPTION RATES

United States and Mexico ---------- One Year, $3.00
Canada ---------- One Year, 5.00
Foreign Countries ---------- One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

The Automobile and Automotive Industries is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Lowering the Grade of Gasoline

AN official of a gasoline-producing company proposes that the standard of motor fuel be lowered in order that the threatened shortage of gasoline be averted. He believes that a difference in the gravity of 2 degrees Baumé would not cause automobile owners any trouble, and a lowering of the Baumé grade by this amount would result in an increase in the yield of gasoline which would go far toward supplying the expected deficiency. A further saving is expected from the fact that the less volatile grade of gasoline contains a slightly greater number of heat units per gallon.

Unfortunately the grade of gasoline is already so low that large numbers of owners of older cars are meeting with a great deal of starting trouble during the cold season. How serious this matter has become is well shown by the fact that urgent requests have been made to the Bureau of Standards to issue specifications to which fuel sold as gasoline must conform. The trouble is not even confined to starting, for engines much used under light load never get up to their regular operating temperature in cold weather and as a result lack flexibility.

That the higher heat content of the heavier fuel will result in a saving of fuel is an illusion. Under the condition of operation of automobile motors a considerable percentage of the heavier fuel will pass through the engine unburned and is absolutely wasted. Therefore, instead of obtaining a greater mileage per gallon with the heavier fuel the opposite is usually the case in regular operations.

In spite of these objections to Mr. Shatford's suggestion we are not all certain that it will not be carried out. Lowering the gravity has been the common method of increasing gasoline production so far, and it is the easiest way out of the present difficulty from the standpoint of the producers. But consumers, whose patience is often strained when trying to start their cars with the present product on cold mornings, will not consider the fuel problem solved.

A Factory Warning

SOME months ago a building of the Renault automobile plant in the suburbs of Paris collapsed, in which accident thirty of the workpeople lost their lives. A government investigation of the cause of the disaster was started, and a report on it has just been made public. It appears from this that about 100 lathes, weighing 7 to 8 tons each, were installed on the upper floors of a building of steel-girder-and-brick construction with inadequate foundations. Signs of the impending failure of the structure had been apparent, and a deputation of the workers had called upon Louis Renault, drawing his attention to the dangerous condition of the building. The building contractors, however, who were consulted in the matter, after an examination declared that there was no danger, and work was continued. It was only a short time later that the collapse occurred, with fatal results. Since that time another building of the Renault plant has been wrecked in a gale, the cause also being insufficient foundations.

These accidents have caused consternation among the workpeople in the neighborhood, for the same conditions which obtained in the Renault factory are duplicated in many other plants. Many factories have been adapted for work of a nature different from that for which they were originally designed, and in order to force production the machine tools have been placed as closely as possible and are run at the maximum speed. As a result the factory floors are now carrying loads far beyond their safe limits.

Lessons for United States

The Renault accident is not without its lessons to America. We are about to convert many of our factory plants to new uses and in numerous lines there will be every inducement to speed up production to the very limit. However, the requirements of safety must not be ignored. It may be that war conditions warrant somewhat greater risks than ordinarily permissible, but such accidents as that at the Renault plant, involving a serious loss of life and property, must be avoided if at all possible. For instance, there have been rumors that a certain concern expecting a large government order proposed to erect a plant for its execution in a single day.

This suggests hasty, careless construction. Speed, of course, is necessary in turning out the products required for making war, and in getting ready for it, but as under other conditions haste not only makes waste, but too much haste often defeats its own purpose.

Vibration

IT would be a much better achievement to maintain a lack of vibration in the car than it is to secure it in the design on the drafting board. Frequently a car which has been designed to be free of all vibration and which will be practically so when it is turned over to the new owner will soon develop vibrations that are far worse than those due to an incorrect crankshaft.

The causes for these vibrations are looseness in connection throughout the chassis or an improper placing of loose tools and other articles. One of the most fruitful sources of trouble is in the bolts which secure the motor to the frame, and another cause which is almost equally frequent is in the muffler and exhaust pipe attachments. The loose motor bolts will cause the whole car to vibrate at certain speeds and will give the motor an exceedingly rough sound at these speeds. Another symptom of this trouble is the rumbling sound throughout the car when it crosses inequalities in the road.

While not a dangerous matter, it is certainly not giving the buyer the best possible product when every means is not taken to secure the fastenings on the car which have to do with parts such as these which are apt to rattle and develop vibration. The point is obvious that it hardly pays to go to a great amount of expense to secure balance and good performance unless these little things are taken care of as well in the assembly department.

Unreasonable Exemption

THE matter of industrial exemptions will soon become an important one to all manufacturers in the industry. These columns have already told of the importance of exempting those men actually essential to the industry—and of the trials and troubles endured by France in the early days of the war when all were drafted regardless of their position or knowledge.

This week's news dispatches tell of a request for exemption for six employees of a very large factory denied by the district appeal board. The request was for the exemption of such employees as rate clerks, stock chasers and dispatchers, men who could be replaced and are not vitally important to the industry, men whose work does not in itself make for improvement of product or production.

If manufacturers are to secure justice from the exemption boards they should in all fairness make just claims. If they desire to secure exemption for metallurgists, engineers and others of like importance, they should reserve their exemption claims for such individuals, or else they will find all exemption pleas treated with equal contempt whether they apply to stock chasers or to chief engineers or production managers.

It will be well for each manufacturer and for the general industry if every exemption claim is given thorough consideration before it is made, to ascertain if the individual is actually of vital importance to the concern and to the national interest.

The ancient story of the boy who cried "wolf" too often is too familiar to require repetition—but it is worthy of thought in connection with exemptions. And employers who will seek exemption for the genuinely important workers should bear it in mind before making appeals for wholesale exemptions or for exemption of minor employees.

U. S. Aviation Motor Makes Good

THAT the U. S. aviation engine, also called the "All American," has been built, tested and proved good is now public property. It is also known that it is planned to produce just this engine and no other for use in American fighting airplanes. Another fact which is not concealed is that the engine design is such that different powers can be obtained by different combinations of similar units—cylinders, for example, being a standard size but capable of different grouping.

Beyond this it is very positively stated that no more information will be given out, in which procedure the Washington authorities are following precisely the steps of the British and French governments with regard to the engines which they held in highest esteem.

It was known for a long time that the Sunbeam and Lorraine Dieterich were two of the best engines in Europe. Details of the Sunbeam were published after a sufficient number of these engines had fallen into enemy hands to make concealment absurd. Of the Lorraine Dieterich no details have yet been permitted to go out.

Whether the policy is good or bad is hard to tell. There is no detail of the U. S. aviation motor which is not known to so many people that an enemy agent could find out all about it, but he might have trouble and would certainly take a risk in making too many inquiries.

On the other hand, the resources of the country are to be used in making this engine and by announcing in some detail what it is unexpected sources of parts supply might be discovered. Particulars of the results obtained in the tests would serve to stimulate enthusiasm for the new engine in circles where there is now a good deal of antagonism, and it is hard to see how a mere announcement of the power developed, the weight per horsepower and so forth could do any harm whatsoever.

However, to those who know them well, the fact that the men directly responsible for the engine are satisfied with it counts for much. They are not men to use the word "satisfied" too easily, they are incapable of misjudging the result of tests or of letting enthusiasm run away with them. They have, and will retain, the confidence of the industry.

News of the Automotive Industries

Aircraft Buying On Cost Basis

Contracts Will Be Let on Cost of Production Plus a Per Cent

WASHINGTON, Aug. 28—At the offices of the Council of National Defense it was officially stated that contracts for airplanes or parts now being made and to be made will be on a cost-plus basis. It is possible contracts may be made for a lump sum with stipulations to the effect that should the actual cost, plus say 10 per cent when the contract is completed, prove less than the lump sum agreed upon, deductions in favor of the Government would be made.

Alleged excessive prices charged in the past, or up to May, 1917, when the aircraft production board took charge, are explained by the statement that buying in large quantities had not prevailed up to that time, resulting in the higher cost; also, that parts were purchased separately instead of being assembled, which naturally meant higher prices.

At the office of Howard E. Coffin it was specifically denied that Coffin had intended or threatened to commandeer aircraft factories because of the high prices charged prior to May, 1917. However, a congressional investigation is probable as a leading member of the Senate has said he would introduce a resolution calling for an investigation of such prices.

The War Department is back of the amended bill of Senator Sheppard of Texas, under which an aircraft board not to number more than eleven, including a civilian chairman, the chief army officer, at least two other army officers, the chief navy constructor, and at least two other navy officers, would be created. The board is to be empowered to supervise the purchase, production and making of aircraft, engines and accessories, under the direction of the secretaries of war and navy. The bill appropriated $100,000 for the board's administrative work.

Government officers said to-day the present board had brought about, by buying in large quantities, savings of approximately 50 per cent in the cost of aircraft, with probably still greater reductions.

—

Body Builders Wanted for Ambulance Service

NEW YORK, Aug. 26—A few vacancies still remain in the ambulance service for the following classes of men: twenty-five body builders; twenty-five body finishers and painters.

Those able to qualify will be enlisted in the United States army and may look forward to service abroad within a short time. It should be noted that the ambulance service offers practically the only opportunity for body builders and finishers to practice their profession in military life. Applicants should call at the office of the American Red Cross (Men's Enrollment Department), 389 Fifth Avenue, New York City, between 10-5 weekdays, Saturdays 10-12. The applicants should be prepared to establish qualifications by good references.

—

Lelands Form Lincoln Motor Co.

DETROIT, Aug. 29—Henry M. Leland and Wilfred C. Leland, who resigned as president and general manager of the Cadillac Motor Car Co., have completed organization of a $1,500,000 airplane company. The concern has been incorporated as the Lincoln Motor Co. and has a factory composed of buildings formerly occupied by the Rands Mfg. Co. One hundred men are now at work. Two thousand will be employed soon.

An output of twenty airplane engines per day at an early date is assured. Immediate associates in the company are: Lelands; W. H. Murphy; Joseph Boyer; John Trix; George H. Laying; W. R. Johnson; William T. Nash; Frank Johnson; A. U. Widman; Ernest E. Sweet; Le Roi J. Wildams; E. T. Randall; J. Wilbur Brown, and M. W. H. Wilson. The company will manufacture U. S. A. engines.

—

Farmers Want Tractor Operators

KANSAS CITY, Aug. 25—The often repeated statement that one of the greatest needs of the tractor industry is to educate farmers in the use of that machine was borne out strongly by the Kansas City conference on increased grain production. During this conference both in and out of the meetings a number of items of information were given which seemed to point to inefficient tractor handling. For example, it appears that very many tractors are lying idle because they have given trouble and the owners have not endeavored to get expert assistance. A sidelight on this is seen in the fact that among the many demands for labor heard from the wheat belt this summer a shortage of tractor operators was never mentioned, but every tractor operator who went into that district obtained a job immediately.

It was also suggested that dealers are to some extent responsible for this state of affairs.

Chalmers-Maxwell Consolidation

Chalmers Raises $3,000,000 and Leases Plant to Maxwell for 5 Years

NEW YORK, Aug. 27—Although not a merger the Maxwell-Chalmers agreement appears to be likely to have much the same effect on the two companies. Since the proportion of the Chalmers factory which it is expected to use for Maxwell purposes is small, it will be possible to continue a large output of Chalmers cars. It is probable that the Maxwell and Chalmers will be linked together in future sales by being confined to dealers who will take the two lines together.

The management will be entirely in the hands of the Maxwell company and Hugh Chalmers will be chairman of the board. The status of other Chalmers directors is not yet determined.

While it is understood that the Maxwell company requires the additional factory space to take care of anticipated government orders for trucks or other articles, it is also planned to continue the manufacture of Chalmers cars.

The plan of financing as proposed by the Chalmers Motor Corp. will raise $3,000,000 and calls for the leasing of its plants and assets to the Maxwell Motor Car Co. for 5 years. Provision is made for the issuance of $3,150,000 first mortgage 6 per cent 5-year notes, secured on the real estate, plant, and fixed assets of the Chalmers company, which notes are to be taken at 95 per cent of par by the holders of the 264,000 shares of stock in the hands of the public at the rate of $10 of such mortgage notes for each share of stock now held by them. Each stockholder subscribing will get one share of 8 per cent cumulative preferred stock of par value of $100 each for each three shares of old stock held and to the extent of 50 per cent of his present holdings. The 8 per cent cumulative preferred is retirable at 110 and interest, and redeemable under a sinking fund of 3 per cent, commencing July 1, 1920.

Each subscribing shareholder is to receive one-quarter of a share of additional no par value stock as a bonus for each $10 of the notes so subscribed for. If all the shareholders take their full proportion of the notes there will remain $360,000 of notes, which J. S. Bache & Co. and C. D. Barney & Co. have agreed to purchase at the same price made to stockholders.

As part of the plan whereby the

(*Continued on page* 384)

Oil Equipment Scarce

Work at Wells Retarded—Lack of Materials Causes Shutdowns

WASHINGTON, Aug. 26—Recent authoritative statements regarding the gasoline situation have been so vague that the industry has had no opportunity of judging whether the situation is serious or not. It appears that one of the principal things which are retarding the production of oil is the great difficulty in getting equipment for the wells and the further delay in transporting that equipment to the places where it is wanted.

It also appears that every effort is being made to tap first sources of supply and that Government restriction on the use of oil is not yet being considered.

Director Van Manning of the Bureau of Mines has taken up the matter with the Council of National Defense, and he hopes some way will be provided for furnishing the supplies needed. The shortage in supplies is said to be due to two causes, first, the great demands being made on all lines of manufacture and the inability to get materials needed; second, the delay in transportation of supplies to the oil territories. Already from Pennsylvania to California, according to Mr. Manning, small producing wells are being abandoned that equipment may be used for new wells from which larger production is expected.

No Government Control Likely

Control, in the public interest, of the production and distribution of crude oil, and the products of the same by the President, is regarded as not unlikely, this step, if it be taken, to be announced in a short time. Complete authority is given the President under the Food Control Bill to take such a step, the law providing that he may make regulations and issue such orders as are essential to that end, as to "fuel, including fuel oil and natural gas, tools, utensils, implements, machinery and equipment required for the actual production" of the same; also, the President is authorized "to requisition and take over, for use or operation by the Government, factory, packing house, oil pipe line, mine or plant, or part thereof."

Officials admit that regulation of the production and distribution of crude oil and its products probably would come next. Should this come the Government, not being authorized to fix a scale of prices for oil, will most probably provide a licensing system under which the industry will be required to operate.

Mexican Supply Large

E. L. Doheny of Los Angeles, who has been attending oil conferences in Washington, has expressed the opinion that every effort ought to be made to increase the supply in the Mexican wells. He stated that something like 800,000 barrels a day are being produced in Mexico, and that no attempt is being made to move the oil because of the shortage of pipe lines to the coast. He considers that a million barrels a day could be added to our oil supply easily if some protection could be given to the wells and the equipment which it is desired to build.

It is also stated that the Government could, if necessary, open up large areas in the West which were closed to development in 1910, but here again the difficulty in obtaining equipment would have an influence.

—

GASOLINE PRICES INCREASED

NEW YORK, Aug. 28—Gasoline prices have been increased 1 cent in a number of the Eastern cities. The local market, however, remains unchanged. The firmer tone of the market was evidenced by an advance of 1 cent to 27 cents in Philadelphia by the Atlantic Refining Co., following the similar increase to 21 cents by the Standard Oil Co. of Indiana last Friday. The price has also been increased 1 cent a gallon to 20.4 cents at filling stations in St. Louis.

—

CASINGHEAD GASOLINE PRODUCTION A PROMISING FACTOR

WASHINGTON, Aug. 27—The natural gas-gasoline industry promises to become a factor in the oil situation according to the *Geological Survey*, which has been giving much attention to this subject. John D. Northrop, of the *Survey*, states that the year 1916 was one of marked expansion in this industry, the quantity of raw gasoline extracted from natural gas, including that produced by the compression and absorption methods, as well as that obtained by the use of vacuum pumps and recovered as drips from gas transmission lines, and sold in that year was 104,212,809 gal., a gain of 38,848,144 gal., or 59 per cent over that of 1915.

The quantity of commercial gasoline represented by this output of raw, casinghead product was probably more than 200,000,000 gal., it is estimated.

The average price received in 1916 for the unblended product at the sources of production was 14 cents a gal., and the market value of the entire output was $14,408,201, a gain of 6 cents in average unit price and of $9,257,378, or 180 per cent. in total value, compared with 1915.

The volume of natural gas from which this quantity of gasoline was recovered is estimated at more than 208,800,000,000 cu. ft., the average recovery of gasoline per 1,000 cu. ft. by all methods being about ½ gal. The number of plants for extracting gasoline from natural gas increased from 414 at the beginning of 1916 to 594 at the end of the year.

Of gasoline thus extracted the output by States was greatest in Oklahoma, by gallons, with other States producing in order as follows: West Virginia, California, Pennsylvania, Ohio, Illinois, Louisiana, Texas, Kentucky, Kansas, New York, Colorado.

Springfield Body Men Meet

Stockholders Receive Financial Report and Elect Representatives

DETROIT, Aug. 24—Liabilities of the Springfield Body Corp. scheduled at $638,000 when the balance sheet was recently issued to creditors have mounted to $800,000, while the assets of the corporation have decreased more than $2,000 in the same period. At a meeting of creditors held this week it was stated that material valued at $350,000 was largely overestimated and is not more than $150,000. Three companies are involved in the proceedings, including the Springfield Body Corp. of New York, the Springfield Body Co. of Massachusetts, and the Springfield Realty Co. of Michigan. Creditors will ask the United States district court to appoint B. F. Everett, present receiver, as trustee. A committee has been appointed including George W. Woods, chairman, George I. McClure, J. A. Milott, F. C. Sibley, George C. Dyer, Walter N. Kelly and J. B. Mansfield to act with the receiver in the sale of properties of the corporation.

Stockholders of the defunct corporation met last Thursday in New York, where they received a report on the financial condition of the company. A stockholders committee was also elected to represent them in the future business of the corporation. Morris L. Ernst of Greenbaum, Wolff & Ernst is temporary chairman.

The company started manufacturing in its new Detroit plant last April and was turning out bodies when the war came, causing cancellations of contracts. This followed with the discovery that the new plant cost $1,000,000 instead of $750,000. The next discovery was that bodies were being sold at too small a profit. Increased capital was necessary and the New York brokers were called upon to help out. In the meantime, E. W. Wagner & Co. had bought out Renskorf, Lyon & Co., New York, who had engineered the financial deal and floated the stock issued by the Springfield Body Corp.

The first request for funds was without results. The news spread to Wall Street and the stock dropped from $103 per share to $5 per share. Then the Wagner company purchased the controlling interest of the company by paying W. L. Fry, the Springfield Body president, $5 per share for its common stock. Soon after came the involuntary bankruptcy proceedings and the appointment of B. F. Everett as receiver.

The company had $2,700,000 worth of orders on hand, but on account of lack of funds to carry out the contracts it could not fill them.

It is stated the company had nearly thirty licensees under its body patents, but collected only $13,000 this year in royalties.

England Helps Farmers

Supplies Tractors—Food Production Board Wants Increased 1918 Harvest

LONDON, Aug. 6—Sir Arthur Lee, Director General of Food Production, has issued a statement explaining the policy of the Food Production Department with regard to tractors and other agricultural implements. He says that the Cabinet has decided that a large increase must be made in the acreage under corn and potatoes for the 1918 harvest, and that in consequence it has been the duty of the Food Production Department, acting through the agricultural executive committees, to apportion the task between different parts of the country and to see that the best use is made of existing resources.

The first object aimed at is to insure that all farmers make the fullest use of the resources at their disposal. To accomplish the program, however, the department will have to assume responsibility for that residue of the task which is beyond the power of the farmers to carry out unaided. To this end the department is obtaining and placing at the disposal of country committees a large number of tractors, horses and other requisites, and arrangements have already been made for the purchase or loan of the full quantities required. Owing to shipping difficulties and other troubles, many delays have been experienced, but these are being overcome.

—

Marion Tractor Demonstration a Success

MARION, OHIO, Aug. 24—Eight makes of tractors and twelve machines made up the list of entries in the first exclusive farm tractor held in Ohio on Aug. 22 and 23 at Marion. Between 4500 and 5000 farmers were present the second day at the demonstration grounds 6 miles east of the city.

In the demonstration of plowing ability each tractor was required to plow an 8-in. furrow and to run in a straight line. The land to be plowed was measured, staked and assigned to each machine on the basis of the number of plow bottoms pulled, width of plows and spread of machines. An average of an acre an hour was made by the machines although some of them made more than that.

Chalmers-Maxwell Consolidation

(*Continued from page* 382)

Chalmers corporation will work off its stock of materials the Maxwell company will turn out Chalmers cars, convert the Chalmers inventory into cash and apply it to the payment of its obligations. It agrees also to provide whatever additional capital might be needed to assure payment of the interest on the $3,000,000 of notes to be issued and adjust the relations between the Chalmers company and its bank and mercantile creditors. The Maxwell company guarantees to return to the Chalmers concern 50 per cent of the net profits from the operations of the plant.

The mortgage notes besides being definitely secured on real property costing more than $6,000,000 and carried at more than $4,000,000, has total assets as margin of safety of over $17,000,000.

—

Paris Places $2,260,000 Truck Order

PARIS, Aug. 15—An order for 100 Fiat 3½-ton trucks and an equal number of Pierce-Arrow 5-ton trucks has been placed by the Municipal Council of the City of Paris. The total expenditure is $2,260,000. The price of the Pierce-Arrow trucks is $9,600 each, and the Fiats $6,800 each. In addition $620,000 are being spent on spare parts.

The municipal trucks are to be used for the distribution of coal, flour, and general food stuffs in the city of Paris and surrounding districts during the coming winter. Last year the city had a stock of 200,000 tons of coal which it had to distribute to local committees and small dealers, but having no trucks, it had to appeal to the army for assistance. During the coming winter the coal stock will be at least 500,000 tons for the city of Paris, and 800,000 tons for the surrounding district. In addition, large quantities of potatoes and flour have to be distributed. The city will have the trucks entirely under its own control, and not in the hands of an intermediary. Special garages are being erected, and all drivers and mechanics will be in the pay of the city of Paris.

The placing of this big order for foreign trucks has given rise to considerable discussion in the municipal council chamber. Originally it was hoped to get French trucks, but on a formal application being made to the War Department to allow the French factories to deliver, a refusal was met with.

Railroad facilities being insufficient between Lyons and Paris, the Chamber of Commerce of the former city has decided to run a regular automobile truck service between these two places. The distance for the round trip is nearly 600 miles, thus making this the longest route over which a regular truck service has ever been established.

—

Zimmerschied Completing Steel Specifications for Airplanes

WASHINGTON, Aug. 27—Specifications for steel for airplane parts, being prepared under the direction of Karl W. Zimmerschied, are about complete. The task has been an arduous one and Mr. Zimmerschied has surrendered his position as vice-chairman of the Co-operative Committee on Automotive Transport that he might give more time to the steel specifications.

Mr. Zimmerschied also is giving much time to the Committee on International Airplane Standardization. His successor on the Committee on Automotive Transport has not yet been announced.

England Specializes on Airplanes

Automobile Business at Standstill—Light Cars Popular—Women Take Men's Places

LONDON, Aug. 27—English factories are turning out 800 airplane engines daily at the present time, while the automobile business is almost at a standstill, the factories formerly engaged in building cars now turning almost all their attention to the making of airplanes and munitions. This is the word brought direct from London by J. B. Clarkson, Managing Director of Hope, Gibbons Sons & J. B. Clarkson, Ltd., Wellington and Christchurch, N. Z, who is now on his way to the Antipodes after having spent some months in Great Britain and also the United States purchasing supplies for which his company is a distributor in New Zealand and Australia.

Light cars that sold for $1,000 to $1,500 3 years ago now have a market value of from $2,500 to $3,000, notwithstanding their age. Owners of heavy cars are the buyers of these used light cars. They find the lighter vehicle more economical in fuel consumption.

England is turning out expert aviators at a rapid pace, and these men get practical flying instruction almost from the start. There is no long period of training, and the prospective pilot is given charge of a plane under the direction of an instructor without much, if any, preliminary work. The Allies have drawn the lines closely in designating the physical type of men who can enter the air service, much the same as the United States Signal Corps has done in this country.

England is not concentrating on any one type of aviation engine such as the United States has in mind, but factories are turning out duplicates of those types which are found to be the most dependable in actual conflict.

English women are performing most of the tasks that once were done only by men. Seventy-five per cent of the farm work, Mr. Clarkson says, is now done by women in Great Britain, and women are to be seen as elevator operators, bus drivers and street car conductors. In the munition factories and machine shops, by far the greater percentage of workers are women.

—

Automotive Electric Assn. Meets Sept. 6

NEW YORK, Aug. 27—The Automotive Electric Assn. will hold its summer meeting at the Mansion House, Fishers Island, N. Y., Sept. 6th, 7th and 8th.

Reports will be submitted by committees as follows: Standards, patents, commercial forms and practice, and cost accounting.

Papers on the following subjects will be presented: Operating Under Patents; Advantages of Standardization; Aeroplane Equipment, and Why and In What Way Should We Advertise.

Seven Body Styles for Jordan

On Single Chassis—No Mechanical Changes—Colors Are Optional

CLEVELAND, Aug. 25 — Seven body styles now comprise the standard line of the Jordan Motor Car Co. Four of these are new, being first shown at the dealers' conference at the factory, Aug. 24 and 25, and all being unusual in that they are distinctive, custom style, closed types of aluminum structure.

All seven bodies are mounted on a single chassis which has no mechanical change. The line is notable because of the fact that the cars are all possessed of an individuality of body and color which tends to give the impression that each car is a custom rather than a stock product.

The four new closed bodies are the sport limousine, brougham, town car, and sedan. In addition there is a seven-passenger touring, roadster, and four-passenger sport car. All these cars have optional colors and are in line with the principle of the Jordan company to build cars of striking but tasteful design and color.

Fifty dealers have been assembled here for the last two days, holding the first annual conference of the distributors of The Jordan Motor Car Co. The distributors have been brought together for the purpose of viewing the complete line of inclosed body jobs, and for the purpose of taking their orders for the coming season. At the same time a general sales conference has been carried on for the purpose of infusing the members of the sales organization with the basic ideas upon which the Jordan cars are sold.

A special custom made body, fitted to the standard Jordan chassis and appropriately named the Jordan sport limousine, finished in Copenhagen blue, was shown to the distributors. In a drawing contest for this, Charles E. Baker of Detroit held the ace of hearts. Only one of these jobs will be provided for each distributor. They will not be available to individual purchasers. The prices of the entire line are as follows:

Sport limousine, $3,300; maroon, tan, grey, bronze, yellow.
Four-passenger brougham, $2,900; blue, green, tan.
Seven-passenger sedan, $2,650; maroon, green, blue.
Town car, $3,100; grey, maroon, green, blue, tan.
Roadster, $1,795; red, green, blue.
Sport car, four-passenger, $1,895; grey, blue, green, tan.
Seven-passenger touring, $1,795; maroon, grey, green, blue.

—

Wolverine Roadster $3,000

KALAMAZOO, MICH., Aug. 20—The Wolverine Motors, Inc., of this city, are bringing out, as has been previously announced, the new Speedway Special car in the form of roadster and touring models. The roadster has two-passenger capacity and sells for $3,000, and the touring car seats four with two extra folding seats, and sells for $3,250.

The wheelbase of the roadster is 115 in. and the touring car 125 in. The car will be fitted with a Wisconsin powerplant, having four cylinders cast in block. The bore is 3 61/64 in. and the stroke 6 in. The carbureter is a Rayfield and the ignition system a Bosch. The power is transmitted through a multiple disc dry plate clutch, and a Warner gearset in unit with the engine.

Final drive is by a spiral bevel axle made by the American Ball Bearing Co. This is a floating type and is geared 2.94 to 1 on the roadster and 4.1 to 1 on the touring model. The tires are 32 by 4½ in. all around and are cord type. The drive is transmitted through the springs, which are semi-elliptic. The Lavigne steering gear will be used, and a Warner speedometer and Hartford shock absorbers will also be stock equipment.

—

Packard Has Bijur Lighting

NEW YORK, Aug. 27—Electrical equipment of the Packard car consists of Bijur generator and Bijur starting motor combined with Delco ignition distributer. In a recent description of the Packard car this was not clearly stated.

—

New Jones Chassis Are Standard — Bodies Attractive

WICHITA, KAN., Aug. 25—Attractive bodies and standard chassis units are the particular features noted in the Jones 6-60 which sells for $1,675 either as a five-passenger touring car with divided front seats or a seven-passenger. The latter with victoria top is $100 extra.

The engine is a six-cylinder, 3½ by 5⅛ Lewis, with cylinders cast in a block. A Borg Beck dry-plate clutch and three-speed gearset are in unit with the engine.

The electrical equipment consists of a two-unit starting and lighting system and an ignition distributer, all made by Remy. Stromberg carbureter with dash adjustment is employed.

In the gearbox the gears and their shafts are made from 3½ per cent nickel steel and annular ball bearings are used throughout.

The rear axle is Timken with spiral bevel drive, and the brakes have 14 in. drums. The emergency brake is expanding and the service brakes contracting. The front axle is also a Timken.

Drive and torque are transmitted through the springs, a driveshaft with two universal joints being used.

Wheelbase is 125 in. and tires are 34 by 4, straightside, non-skid front and rear, with Firestone demountable rims.

—

Minerva Using Pierce Governors

ANDERSON, IND., Aug. 27—The Pierce Governor Co., Anderson, Ind., has contracted with the Minerva Motors Co., Amsterdam, Holland, to supply Minerva trucks with Pierce governors as standard equipment. This order will amount to about 5000 governors during the next year.

N. A. P. A. Meet Oct. 9

Pittsburgh Gathering To Be Most Important in It's History

NEW YORK, Aug. 27—The National Assn. of Purchasing Agents will hold their annual convention in Pittsburgh Oct. 9, 10 and 11. The details of the convention are being worked out by Robert F. Blair of the Pittsburgh Gage & Supply Co., who is chairman of the convention committee. E. L. McGrew of the Standard Underground Cable Co., is the National Association's president.

The registration of delegates will take place on Oct. 9 at the William Penn Hotel, which will be the headquarters for the convention, and where also the convention meetings, both public and closed, will be held, and where the annual banquet, with men of national prominence for speakers, will be held. Sight-seeing tours throughout the Pittsburgh industrial district are being arranged.

It is considered that this meeting will have a special appeal in that the vast buying by centralized government departments is bound to have a profound influence on all business. One of the foremost subjects for discussion will be how to meet existing conditions and still more, how to look forward and estimate conditions in the near and distant future.

—

Harley-Davidson Gives Military Motorcycle Instruction

MILWAUKEE, Aug. 27—In order to familiarize army officers with the construction and mechanism of the motorcycle, the Harley-Davidson service department has been converted into a school of instruction. The first class of pupils comprises nine corporals from the regular army, southern department, signal corps, Fort Sam Houston, Texas, as follows: Corp. David N. Johnson, El Paso, in charge; Corp. Eric B. Becker, Fort Sam Houston; Corp. F. J. Cassidy, Fort Bliss; Corp. F. M. Amerman, Brownsville; Corp. W. T. Allen, Fort Bliss; Corp. Walter I. Wilson, Marfa; Corp. L. Segall, Brownsville; Corp. Grover F. Brandt, Fort Bliss and Corp. Earl H. O'Connor, Fort Sam Houston, all of the signal corps.

The men are going through a regular course of instruction, arranged by Joseph G. Kilbert, of the Harley-Davidson service department, which includes an inspection tour through the main factories, preliminary instruction in motor work and lectures and demonstrations bearing on the design and construction of the motor, the oiling system, the carbureter, the frame, wheels and brake, clutch and transmission, drive chains and sprockets.

The course is completed by a study of tire and tube care and repair, instruction regarding the sidecar, and driving lessons on the road, during which emphasis is laid on the care and adjustment of the motor and various parts of the vehicle, including the sidecar.

Industrial Review of the Week

A Summary of Major Developments in Other Fields

NEW YORK, Aug. 29—The readjustment of business from a peace to a war basis is just beginning to make itself felt. Civilian trade in many lines is duller than at any time since 1914. This is not necessarily a cause for pessimism for it has been necessary to reduce the volume of normal trade in order that the industries of the country may handle the mammoth war program.

The labor scare of the past week has died down somewhat, and the probability of any extended strikes has been lessened. The most important factor in the general situation is the price fixing activity of the Government. Many lines are at a standstill until it is clear what prices will be determined for such basic products as steel and copper.

A New Service

¶ Herewith THE AUTOMOBILE AND AUTOMOTIVE INDUSTRIES *supplies for the benefit of its readers a general summary of important developments in other fields of business. This is rendered possible by the editorial cooperation of leading industrial publications which are recognized authorities.*

By compressing the general industrial situation into this form we hope to give our readers a clear and comprehensive idea of up-to-the-minute developments which they could otherwise secure only with considerable expenditure of time and effort.

Too Much Waste

The necessity for reclaiming industrial waste is becoming more apparent each day, especially in the engineering field. The shortage of material and the inability to fulfill Government contracts, has become so acute that something must be done to counteract this serious problem. There is a movement on hand in the engineering field to send a petition to President Wilson asking him to set aside a week to reclaim or salvage old metals, etc. This period would be called Conservation Week and the various industries should make it a point that this waste material is utilized to the best advantage. The shortage of material is really as serious as is that of labor.—*Engineering Magazine.*

$350,000,000 for Destroyers

Paramount in the marine world is the announcement that Secretary of the Navy Daniels would ask Congress for an additional $350,000,000 for the construction of torpedo boat destroyers. As was announced last week, this amount will buy about 350 of these vessels at present costs of production. Of equal importance is the announcement of the building of 10,000,000 tons of ships for this country within a year during which $2,000,000,000 will be spent. The Government will build 1270 vessels aside from the commandeered bottoms. Commandeering will cost $155,000,000 and the purchase of ships, $150,000,000.

Agreement has been made by the Navy Department to adjust all labor disputes so that shipbuilding may be rushed. A commission will soon be appointed to solve the problem.—*Marine Engineer.*

Coal Trade Satisfied

Fixing of prices for domestic sizes of anthracite practically the same that the large producing interests have been charging was hailed with satisfaction by the coal trade. The bituminous market, on the other hand, is stunned by the Washington prices. No sales were reported at any price following the announcement. Meanwhile shipments to Canada continue heavy. The Northwest is getting a large amount of coal shipped to that section by order of the Railroad Board.

According to President Wilson's announcement, a jobber shall not add to his purchase price of coal a gross margin in excess of 15 cents per ton of 2000 lb., nor shall the combined gross margins of any number of jobbers who buy and sell a given shipment or shipments of bituminous coal exceed 15 cents per ton of 2000 lb.

For buying and selling anthracite coal a jobber shall not add to his purchase price a gross margin in excess of 20 cents per ton of 2240 lb. when delivery of such coal is to be effected at or East of Buffalo. For buying and selling anthracite coal for delivery West of Buffalo a jobber shall not add to his purchase price a gross margin in excess of 30 cents per ton of 2240 lb.—*Coal Age.*

Sharp Fluctuations in Steel Market

Even with the Government announcement of steel prices known to be close at hand, the market has done some further readjusting on its own account. Pittsburgh has been the chief scene of activity and the business done has been almost uniformly at the expense of prices.

In semi-finished steel, the high peaks of two months ago, reached in early delivery transactions, and which were far above the levels of contract steel, have been toppled over on very moderate business, while in steel-making pig iron the reductions amount to $2 on Bessemer and as much as $4 on basic.

Finished material markets have shared little in the decline in Bessemer and basic iron and billets, chiefly because buying was so limited, but plates in particular are lower, 8c., Pittsburgh, being now common, representing a decline of $20 per net ton.

Manufacturers of steel and munitions have made efforts to release large numbers of men from the draft and some important plants will suffer serious reduction in output if these efforts are not successful. At the same time it is known that very large additions as to the Government demands upon the country's steel capacity will come out as soon as the price-fixing problem is disposed of.

At an important meeting with tin plate manufacturers at Washington on Aug. 24 the food administrator presented figures indicating a shortage of about 2,000,000 boxes this year and a greater shortage in 1918. It was decided to limit further the sale of tin plate to packers of non-perishable foods, also to cut down sales to jobbers. The Government is urging the sale of tin plates to canners for a year ahead, a practice the makers long ago discontinued and which they are averse to resuming.—*Iron Age.*

—

England to Export Wool to U. S.

Licenses have been granted for the exportation of merino wools from England to the United States. This is in line with the various reciprocal agreements which are being put into effect between the two countries since the beginning of the war. It is considered probable that this permission to export will be extended to other grades of wool also.

There has been little of moment in the local market during the past week as the raw wool men in Boston and the woolen goods makers in New York are still working on the maximum price list for the Government recently proposed. The schedules will be ready for publication in the near future.—*Textile World Journal.*

Electrical Trade Dullest in 2 Years

For the first time in 2 years business in the normal channels of the electrical world has shown a falling off. The total amount of business being done continues strong, being bolstered by war work. But the civilian market is remarkably dull. This condition is believed to be due to the price-fixing activities of the Government. Producers hesitate to fix prices when the cost of steel, copper, and other raw materials are still uncertain. Buyers are afraid to stock up with goods at comparatively high wholesale prices when a drop in the market is possible.—*Electrical World.*

No Fluctuation in Crude Rubber

Prices in the crude rubber market have remained practically unchanged for a month. The market is suffering from the usual midsummer dullness, and only enterprises connected with the war work are very busy. The shipping situation grows progressively worse. There is a good deal of crude rubber on the plantations, but prices will probably keep up until the transportation facilities improve. The tire business is dull; and the prices of tire fabrics are merely nominal, as the state of the Sea Island cotton crop is uncertain.—*India Rubber World.*

Production and Sales Gaining

Optimistic Feeling Throughout Motor Industry—Axle Business a Barometer

DETROIT, Aug. 27—Orders continue to arrive for cars of popular price in quantities that require production capacity in most plants. Despite the fact that fifty-one manufacturers of cars have increased their prices and that gasoline has increased in price business prosperity continues at such proportions that makers and dealers throughout the country are becoming optimistic. At the same time, however, the manufacturers are displaying caution in anticipation of the future and are passing dividend declarations so as to insure sufficient working capital if conditions resulting from the war justify. The Packard Motor Car Co. has had an increase of 19½ per cent in passenger car sales for the first 4 weeks of the new season over the same period last year. The Franklin Automobile Co. is producing three times as many cars as 6 months past and is breaking shipment records almost daily. These are conditions that are prevalent with all manufacturers of cars selling at $1,500 and less and in some instances as high as $3,500.

The Timken-Detroit Axle Co., an excellent barometer of business conditions, is displaying a substantial gain over last year. In the first half of 1917 the Timken-Detroit Axle Co. reported gross sales of $11,500,000 as compared with $18,000,000 for all of last year, an increase of 25 per cent. During these past 6 months, however, the demand for axles for passenger cars decreased considerably as compared with the corresponding period of 1916, while the axles for trucks greatly expanded. Since July 1 the company notices a substantial increase in the demand for passenger car axles, which seems to show that the shock of the war has been absorbed and which confirms the statements of the many companies who are now reporting record breaking business.

The material and labor situation still remains unsettled. Materials are constantly increasing in price and labor, because of the uncertainty of the draft and because of the increasing demands effective in the past 30 days, is proving a difficult problem. One concern which plans to produce a small car commenced its designs and plans 4 months ago, basing its selling price at $800. This has been increased within the 4 months by 50 per cent and the company now finds that when it announces the new car it will have to charge $1,200 or more—an excellent indication of the material and labor cost increases.

Dealers throughout the country, and particularly those situated close to the new cantonments, anticipate an extraordinary business. They believe that visitors to the camps will contribute to a large parts and repair business. In addition it is pointed out that the camps will create a prosperity for the dealers and the merchants in those cities near the camps and that they will in turn become purchasers of cars.

Visitors in Detroit in the past week point to healthy business conditions in other districts. Eugene Crandall, automobile dealer and writer from Calgary, Canada, states the automobile business in that section has been good and that Ford, Overland, Buick and Studebaker dealers are having difficulty to fill their orders. G. C. Catlin, Hupp representative in South Africa, who has just returned, states that business conditions in that country are breaking all records. The cost of living, he says, is very high but this has produced a condition whereby all of the people seem to have money and spend it. Mr. Catlin states: "The United States should go after export trade now with South Africa. The people there are ready for business with America. They think Americans are the best business men and respect their methods."

—

American Magneto Reorganizing

TOLEDO, Aug. 28—The American Magneto Co., located at Monroe, Mich., and employing 200 men, is reorganizing with a capital of $400,000, and will move its plant to this city. The company manufactures magnetos for automobiles, gas engines and airplanes. It is moving to Toledo because of inability to secure skilled labor in Monroe.

—

Willys Sales Congress in September

TOLEDO, Aug. 27—The Willys-Overland, Inc., will hold what it terms the John N. Willys retail sales congress at its headquarters in Toledo during the first week in September. The coming congress will deal to some extent with manufacturing efficiency and principally with sales increases and will be mainly directed by Mr. Willys. Plans were laid several months ago for the improvement of sales and retail salesmen of Cleveland and Willys-Knight automobiles in every part of the United States were grouped in classes and set out to establish individual sales records for a 3 months' period. Three hundred of the thousands of contestants were given the opportunity to act as delegates to the congress on a basis of personal performance.

No financial credit accrued, the plan being based on the element of honor and distinction gained. The contest closed Aug. 22 and announcements are now being made throughout the country naming delegates to the congress. The visitors will make an inspection of factory facilities, receive cups and trophies and then participate in a Great Lakes cruise aboard the chartered steamer "South American" on which they will hold meetings and discuss such subjects as "How not to sell automobiles," "Fitting the car to the buyer," "Treating the public right," "The evils of exaggerated claims," and other topics on salesmanship.

$25,000,000 Order for Overland

Includes Airplane Parts, Bolts, Nuts, Turnbuckles, Etc., for United States and Allies

TOLEDO, Aug. 29—Willys-Overland Co. has received a $25,000,000 order for airplane parts for the United States and Allies. This order includes bolts, nuts, turnbuckles, etc., and is given on a twenty-eight week contract. Under the contract terms, half of the capacity of the Curtiss plants will be devoted to airplane requirements of the Allies. The agreement applies regardless of the capacity Curtiss finally attains. The Curtiss company will complete 200 biplanes for Great Britain within 2 weeks, the order amounting to $6,000,000.

—

Eastern Motors to Resume Business

NEW BRITAIN, Aug. 24—Judge William J. Larkin, Jr., of Waterbury, receiver of Eastern Motors, Inc., maker of the Charter Oak six, has announced an early resumption of business by the company to the aid of which has come strong financial assistance. Judge Larkin says the company will carry out the original plan to make only the best kind of a car. A meeting of the board of directors was held this week. Plans for resuming business were considered. Possibly the name of the company may be changed and if such should happen the car name would be changed too, in all probability.

—

PRODUCTION

DETROIT, Aug. 24—The Saxon Motor Car Corp. sold 2650 Saxon cars in July, which is at the rate of 30,000 cars a year and is regarded as excellent business by the company for the summer month. Orders are increasing in August.

—

RACINE, WIS., Aug. 20—The Modine Mfg. Co., Racine, Wis., which engaged in the manufacture of radiators for cars, trucks and tractors, in January, 1917, is increasing its capacity from 2500 to 3500 radiators a month. A. B. Modine, well known in the radiator manufacturing industry, is president and general manager.

—

Schofield Tractor Substitute on Market

KANSAS CITY, Aug. 25—The latest tractor substitute is the Schofield auto tractor. It consists of a chassis with front and rear wheels and steering gear. This is so arranged that practically any automobile can be placed on the chassis and clamped in place, the drive then being taken from the rear hubs of the automobile to a ring gear on each of the rear wheels of the tractor chassis. The latter is being designed so that it will accommodate almost any type of automobile, the idea being that there are in the country many used cars which can be picked up very cheaply and in which the engine

and transmission are in perfectly good order.

It is claimed that the automobile can be put on and removed from the tractor chassis very easily so that a car could be used both for its normal purposes and as a tractor. The attachment is to sell for $295.

The Schofield Auto Tractor Corp. is now being organized, with capital amounting to $2,250,000; the patents are held at present by the Webb Jay Corp. of Illinois, and the tractor attachment is at present being handled by the Schofield Laboratories Co. George L. Schofield, president of the latter concern, will probably head the new company.

—

New Used Car Report

CHICAGO, Aug. 27—A new edition of the National Used Car Market Report,—the fourteenth—has been issued. It is considerably simpler than the previous editions and in its new form only "as is" and "as is appraised" prices are given. Figures for "partial overhaul" and "rebuilt" have been eliminated as being not altogether necessary to the completeness of the report. The "as is" sales price is the average actual sales price for which cars have been sold during the period, March 21 to June 21. All models from 1912 to 1917, inclusive, are included in the report, there being prices given on 149 different makes of gasoline passenger cars and fifteen electric cars.

—

Winton Oil Engines for Boats

CLEVELAND, Aug. 25—Alexander Winton, president of the Winton company, is in Portland, Ore., supervising the installation of Winton oil engines in boats for trans-Pacific work.

—

Offers $1,000,000 Buda Stock

CHICAGO, Aug. 27—The Buda Co., through E. W. Clark & Co., is issuing $1,000,000 7 per cent cumulative preferred stock at 96 to yield about 7.30 per cent. The issue is to take care of the expansion of the company's business. The organization was founded 36 years ago, and has a plant at Harvey, Ill., which is given over to the manufacture of railway supplies and internal combustion engines.

—

Universal Manufacturing Increases Scope

RACINE, WIS., Aug. 27—The Universal Manufacturing Co., manufacturing steering gears and other specialties, with plant and headquarters at 1218 Eighteenth Street, has changed its corporate style to the Lorenz Motors Co., and broadened its scope to include the manufacture of engines, trucks passenger cars, tractors, traction engines, ships, munitions of war, weapons, airplanes and similar products.

—

No Wright-Martin Bond Issue

NEW BRUNSWICK, N. J., Aug. 27—No bonds are to be issued by the Wright-Martin Aircraft Corp. A report in financial circles that the company was planning a $15,000,000 issue has been officially denied.

Hupp Co. Earns $337,009

6 Months' Profits Equal to 3.4 Per Cent on Common After Deducting 1916 Loss

DETROIT, Aug. 27—The Hupp Motor Car Co. in the 6 months ended June 30 earned net profits of $337,009, which, after allowing for preferred dividend requirements, is equal to 5.6 per cent on the $5,192,100 common stock outstanding, par $10. In the 6 months ended Dec. 31, last, the company showed a $65,530 loss, so that for the year ended June 30 the company earned a net profit of $271,000, which, after allowing for preferred dividends, is equal to 3.4 per cent on the common stock.

J. Walter Drake, president of the company, stated to the stockholders that development of a lighter car to sell at a lower price is being made at the factory now. The new car will be ready for distribution during the latter part of the year.

The corporation's land, buildings and fixtures have been appraised at $762,740 more than the value shown on the company's books. The enlargements under way during 1916 were delayed on account of difficulty in getting supplies and labor. Therefore, the building additions were not completed and the machinery not ready for service until the early part of 1917.

The corporation's consolidated balance sheet as of June 30, compares as follows:

ASSETS	1917	1916
Plant investment	*$1,482,047	$1,248,728
Goodwill, trade names, etc.	3,858,921	3,858,921
Cash	339,256	490,608
Inventories	2,093,441	2,074,064
Accounts receivable	591,673	504,316
Deferred charges	20,232	48,937
Total	$8,385,569	$8,225,576
LIABILITIES		
Preferred stock	$1,307,900	$1,309,900
Common stock	5,192,100	5,190,100
Due on purchase of Am. Gear Co.	200,000	300,000
Current liabilities (not due)	858,700	785,462
Accrued taxes and interest reserve	40,579	63,889
Customers' deposits, etc.	355,165	325,027
Profit and loss surplus	431,124	251,198
Total	$8,385,569	$8,225,576

*Depreciated valuation.

—

FINANCIAL

NEW YORK, Aug. 23—United States Rubber Co. will earn at least $25 a share on the junior issue of 1917, on the basis of the earnings of the company for the first half of the current year. Tire and mechanical sales alone amounted to $90,000,000. These figures compare with the whole of 1916 as follows: Tire and mechanical goods, $76,000,000.

The company is paying only 17 cents a pound for its crude rubber, compared with 65 cents on the market. It has about $10,000,000 invested in its far eastern plantations. About 15 per cent of its crude rubber requirements will be taken care of this year from its own plantations. This percentage will be increased to 25 per cent in 1918. By 1921 the company should secure about half of its crude rubber requirements from its own land.

—

DETROIT, Aug. 27—The Fisher Body Corp. and subsidiary company reports for the quarters ending July 31, last, show total earnings and income from all sources, including earnings from operations, discounts, interest, etc., amounting to $776,203, and net earnings after interest on the floating debt of $747,349.

—

ALMA, MICH., Aug. 27—It is reported that the Republic Motor Truck Co. will shortly issue 22,000 shares of new common stock at $55 per share to provide working capital for general expansion purposes.

—

DETROIT, Aug. 29—July sales of the United Motors Co. in trucks and tractors amounted to $597,898.31. United Truck & Equipment Co. trailer division earnings amounted to $49,381.82. The company has paid dividends on a 7 per cent preferred stock and accrued by the end of this month $11,446.75, making a net profit of $37,935.07.

The company has purchased 10 additional acres for a new factory. The increased business has amounted to more than 100 per cent on trucks for the period included from Dec. 1 last year to July 31 this year.

A dividend of 1¾ per cent will be paid United Truck & Equipment Co. preferred stockholders Sept. 1.

—

Voting Power for All United Motors Stock

NEW YORK, Aug. 23—The United Motors Corp. has completed arrangements whereby all of its shares are given voting power. Up to the present only Class B stock was given voting power, this class being represented by 5000 shares. Class A stock, of which there are 1,195,000 shares, has been without such right. Certificates are now being prepared which will give all shares full voting power.

—

NEW COMPANIES

DEFIANCE, OHIO, Aug. 24—The motor truck company organization of which was announced last week in THE AUTOMOBILE AND AUTOMOTIVE INDUSTRIES in this city will be incorporated for $1,000,000 and employ 500 men. The truck company will not be a new one in reality but an expansion of an automobile factory now operating in another city.

—

GRAND RAPIDS, Mich., Aug. 27—The Michigan Aircraft Co. has been incorporated for $25,000. The company will maintain headquarters at Grand Rapids and conduct an airplane school at Muskegon, Mich.

—

INDIANAPOLIS, Aug. 27—A company will soon be incorporated at Kokomo, Ind., with a capitalization of $100,000 to

manufacture a new type of tractor wheel which will be known as the "mastodon foot." A. G. Seiberling, general manager of the Haynes Automobile Co., will be one of the men to head the company. The wheels are to be made by contract and sold on royalties.

—

COLUMBUS, OHIO, Aug. 24—The Automatic Control Trailer Co. is the name of a new concern, with an authorized capital of $25,000, soon to be increased to $200,000, which has started in Columbus. Its plant is located at the Broad-Oak Automobile Co., where a factory with facilities to manufacture seventy-five trailers weekly has been provided. It is planned to manufacture trailers, equipped with the automatic brake, and also to make brakes for use on all makes of trailers. The patents cover many improvements of the brake, which is strictly automatic. Tom C. Curtin and H. C. Rogers are at the head of the company.

—

Stungo-Radium Receivership Ended

WASHINGTON, PA., Aug. 27—The receivership of the Stungo-Radium Rubber Co. has been lifted as a result of an opinion of Judge R. W. Irwin. The affairs of the company were temporarily under the control of Attorney J. P. Braden and Joseph Stungo.

—

Postpone Pennsy Receivership Hearing

PITTSBURGH PA., Aug. 27—A hearing on the petition asking for the appointment of a receiver for the Pennsy Motors Co. has been indefinitely postponed, the Potter Title & Trust Co. continuing as temporary receiver.

Maxwell Features Stocks

Chalmers Also Strong on Good Demand for Issue—Other Stocks Are Lower

NEW YORK, Aug. 29—Maxwell and Chalmers this week featured the automotive issues by recording substantial gains. Chalmers common rose 3 points on good demand, and the three issues of Maxwell saw gains of 2⅛ points for the common, 1½ for the first preferred, and ¾ for the second preferred. United Motors showed activity and strength, going up 2½ points to 23¼.

Airplane stocks were not as strong last week. Both Wright-Martin and Curtiss were weak and suffered losses.

—

Emerson Truck Stock Approved

LANSING, MICH., Aug. 25—The Michigan Securities Commission at its meeting Aug. 15 approved the sale of stock for the Emerson Motor Truck Co., Detroit, Triangle Motor Truck Co. of Michigan, St. Johns, the Porter Mfg. Co., of Ann Arbor, Mich.

—

Prest-O-Lite in Merger

NEW YORK, Aug. 27—The merger of the Prest-O-Lite Co., the National Carbon Co., and the Union Carbide Co. has been completed. It is expected that the Air Reduction Co. will be added to this group in the near future.

Tentative terms call for the formation of a new company, with either $200,000,000 stock, consisting of $100 shares, or of 2,000,000 shares of no par value. Union Carbide stockholders will get 2½ shares of the new stock for each of its shares. National Carbon stock will be exchanged share for share, and it is proposed that Air Reduction stockholders should get 1¼ shares for each share of their stock. Prest-O-Lite will get two shares of the new stock for each old share.

There is talk of adding still another company, probably the Linde Air Products Co. The entrance of this company into the group, it is stated, has restricted the negotiations concerning Air Reduction, as these two companies produce similar commodities.

—

DIVIDENDS DECLARED

Pennsylvania Rubber Co., quarterly of 1¾ per cent on preferred and 1½ per cent on common stock, payable Sept. 29 to stockholders on record Sept. 15.

Chandler Motor Car Co., 2 per cent quarterly and customary extra 1 per cent, payable Oct. 1, to stock of record Sept. 15.

Toledo Machine & Tool Co., a stock dividend of 100 per cent to stock holders of record Aug. 27 of the $3,000,000 authorized capital. There will be outstanding $2,400,000 after this dividend is paid. The company paid a 100 per cent stock dividend in 1915.

Amazon Rubber Co., 3½ per cent on preferred, payable Sept. 1, to stock of record of Aug. 20.

—

Two New Directors for Harroun

DETROIT, Aug. 29—Howard F. Lea and A. L. Harroun, both of Kansas City, have been added to the board of directors of the Harroun Motor Corp., which has been increased to eleven members.

Automotive Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
*Ajax Rubber Co.	64	68	—2
*J. I. Case T. M. Co. pfd.	78	85	—4
Chalmers Motor Co. com.	8	11	+3
Chalmers Motor Co. pfd.	..	..	..
*Chandler Motor Car Co.	81¾	82	+1½
Chevrolet Motor Co.	87	90	—2
Curtiss Aeroplane	45	43¾	—3½
Fisher Body Corp. com.	35¼	39	..
Fisher Body Corp. pfd.	88	90	— ½
Fisk Rubber Co. com.	65	70	..
Fisk Rubber Co. 1st pfd.	104	106	..
Fisk Rubber Co. 2nd pfd.	92	95	..
Firestone Tire & Rubber Co. com.	115	118	..
Firestone Tire & Rubber Co. pfd.	102	105	..
*General Motors Co. com.	111	111¾	—1¼
*General Motors Co. pfd.	84½	85¾	—2
*B. F. Goodrich Co. com.	47¼	48	—1¼
*B. F. Goodrich Co. pfd.	103	105	—1⅛
Goodyear Tire & Rubber Co. com.	185	190	..
Goodyear Tire & Rubber Co. pfd.	105	107	..
Grant Motor Car Corp.	2	4	—1
Hupp Motor Car Corp. com.	2¾	3¼	+ ¼
Hupp Motor Car Corp. pfd.	79	81	..
International Motor Co. com.	9	15	+4
International Motor Co. 1st pfd.	35	45	—5
International Motor Co. 2nd pfd.	15	30	..
*Kelly-Springfield Tire Co. com.	44	45	..
*Kelly-Springfield Tire Co. 1st pfd.	87	93	..
*Lee Rubber Tire Corp.	20	21	— ¾
*Maxwell Motor Co., Inc. com.	32⅜	32⅞	+2⅛
*Maxwell Motor Co., Inc. 1st pfd.	67½	68	+1½
*Maxwell Motor Co., Inc. 2nd pfd.	20¾	21¾	+ ¾
Miller Rubber Co. com.	165	175	+5
Miller Rubber Co. pfd.	102	104	..
Packard Motor Car Co. com.	139	145	—1
Packard Motor Car Co. pfd.	94	99	..
Paige-Detroit Motor Car Co.	24	26	..
Peerless Truck & Motor Corp.	13	14½	..
Portage Rubber Co. com.	145	150	+5
Portage Rubber Co. pfd.	..	..	..
Regal Motor Car Co. pfd.	..	22	..
Reo Motor Car Co.	25	27	..
*Saxon Motor Car Corp.	16	18	— ½
Springfield Body Corp. com.	2	8	—1
Springfield Body Corp. pfd.	10	20	..
Standard Motor Construction Co.	9½	10½	—1
*Stewart-Warner Speed. Corp.	55	58	—2
*Studebaker Corp. com.	51¾	52	— ½
*Studebaker Corp. pfd.	..	96	..
Submarine Boat	28¾	29¼	..
Swinehart Tire & Rubber Co.	..	60	..
United Motors Corp.	23¼	23¾	+2½
U. S. Aero. Corp.	6⅞	6½	+ ¼
*U. S. Rubber Co. com.	62½	62¾	— ⅞
*U. S. Rubber Co. pfd.	105	109	—1
*White Motor Co.	45	46	..
*Willys-Overland Co. com.	30½	31	—1
*Willys-Overland Co. pfd.	94	95	—1
Wright-Martin Air Craft.	10	10¼	— ¼

*At close August 27, 1917. Listed New York Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	..	19	..
Bower Roller Bearing Co.	26	29¾	+1
Chevrolet Motor Co.	85	91	—4
Commerce Motor Car Co.	7½	..	..
Continental Motor Co. com.	6	6⅜	..
Continental Motor Co. pfd (new)	..	..	..
Edmunds & Jones com.	..	..	..
Ford Motor Co. of Canada	220	..	..
Hall Lamp Co.	..	20½	..
Hayes Mfg. Co.	..	..	..
Michigan Stamping Co. com.	13	..	..
Motor Products	..	..	..
Packard Motor Car Co. com.	155	162	+15
Packard Motor Car Co. pfd.	97	..	+ ½
Paige-Detroit Motor Car Co.	23½	..	+ ½
Prudden Wheel Co.	..	..	..
Reo Motor Car Co.	28	29	+2½

INACTIVE STOCKS

Atlas Drop Forge	..	39	..
Kelsey Wheel Co.	82	..	..
Regal Motor Car Co.	..	26½	..

Personals

C. E. Broad, who has lately rejoined the engineering staff of the Stanley Motor Carriage Co., Newton, Mass., after an absence of 7 years, has just been made chief engineer of the company. The engineering board now includes Mr. Broad, S. C. Mussey and C. F. Stanley.

—

Leslie R. Acton has resigned from the Redden Motor Truck Co. to become an official of the Huff Laboratories at Miami, Fla.

—

Walter E. Wood, Detroit contractor, has become actively interested in the Wolverine Tractor Co., Inkster, Mich.

—

A. P. Warner has been elected a director of the Bailey Non-Stall Differential Assn., Chicago.

—

James Holden has been made a member of the aviation department of the Government, and has been placed in charge of the purchase and lease of land for aviation fields.

—

L. I. Reis has become secretary and sales manager of the Star Tire Co. with headquarters at the New York office. He has for the past 3 years been Eastern district manager of the Knight Tire & Rubber Co., Canton, Ohio.

—

Charles E. Davy has resigned as general superintendent of United States Truck Co., Cincinnati. Mr. Davy will be located in Detroit after September and will soon announce his new connections.

—

C. S. Vought, assistant general manager of sales of the American Steel Export Co., N. Y., has sailed for France on a 60 days' business trip.

—

F. L. Pierce has been appointed sales manager of the Federal Motor Truck Co., Detroit. Mr. Pierce was formerly sales manager of the Regal Motor Car Co.

—

W. P. Taylor, formerly connected with the Lewis Spring & Axle Co. and until recently general manager of the Hess Spring & Axle Co., Cincinnati, has rejoined his old chief, Fred H. Lewis, at Chelsea, Mich.

—

Milo D. Herron has resigned as secretary and sales manager of the Thomas Auto Truck Co. to take charge as sales manager for the Dart Motor Truck Co., Waterloo, Iowa.

—

Dr. E. A. Planch has been appointed head of the medical and surgical department of the Reo Motor Car Co. Formerly physicians were employed from private practice but this plan did not prove satisfactory, as the doctors were not always available when desired.

—

W. J. Burns, general manager of the United Electric Service Co., of Detroit, has purchased a battery service station at 110 West Main Street, Battle Creek, Mich. This will be a service station for the U. S. L. storage batteries.

—

William Blessing, formerly connected with the service department of the Pullman Motor Car Co., has resigned to become service and traffic manager for the Bell Motor Car Co., York, Pa.

—

N. W. Akimoff, inventor and manufacturer of dynamic balancing apparatus, has just completed the organization of a special laboratory of dynamic balance, with headquarters in Philadelphia. The laboratory will be devoted to the demonstration of dynamic balance, acceptance tests to educating operators of dynamic balancing machines and to practical balancing work.

—

Lucien F. Jalageas, St. Louis, for 7 years with the Kardell Motor Car Co. of that city, has resigned to go into business for himself.

—

H. H. Speany, recently assistant sales manager for the Olympian Motors Co., Pontiac, Mich., has bought an interest in the Welling Motor Equipment Co., St. Louis, distributors for the Olympian cars.

—

C. E. Wells has been appointed assistant manager of the newly organized Omaha branch of the Oakland Motor Car Co., Pontiac, Mich. Mr. Wells was formerly manager of the Baltimore branch of the John Deere Plow Co.

—

E. M. Greene has been appointed supervisor of the Minneapolis Zone for the Maxwell Motor Sales Corp. Several years ago he was supervisor at Cleveland and later at Boston. For a short period he was connected with the London branch. Roy Justice is the new supervisor of the Dallas Zone for the company. He was on the Pacific Coast. Langdon A. Smith, formerly Zone Supervisor at Dallas, has been promoted to general eastern supervisor. He has supervision of the New York and Boston zones. E. E. Thompson has been promoted from manager of branch stores to the position of zone supervisor with headquarters in Cleveland.

—

R. D. Heartz has been made manager of the Moreland Motor Truck Co., Los Angeles, Cal. Mr. Heartz was formerly sales and service manager for the Hupp Motor Car Co.

—

George L. Brush, Canadian manager for the Harroun Motors Corp., has been appointed Canadian manager for the Elgin Motor Car Corp. of Chicago.

—

H. S. Moore has been appointed sales manager of the Wallace C. Hood Service Bureau, Detroit. Mr. Moore was formerly with the Standard Detroit Tractor Co.

H. A. Kiser has been transferred by the Champion Spark Plug Co., Toledo, from northwestern territory to Michigan and surrounding territory.

—

A. B. Cornell, for 15 years secretary of the Empire Rubber & Tire Co., Trenton, N. J., has resigned. He is succeeded by H. R. Nason.

—

H. A. Haviland, manager of the Pittsburgh branch of the Splitdorf Electrical Co., Newark, N. J., has been transferred to the Southwestern territory with headquarters at Dallas, Texas, in place of H. J. Zehner, who has resigned. G. H. Lincoln, formerly assistant manager of the Philadelphia branch, becomes manager of the Pittsburgh branch.

—

A. W. Crossman has become manager of retail sales for the Studebaker Corp., with headquarters in South Bend. P. G. Hoffman, formerly in charge of the retail sales of the Los Angeles branch, advances to the position filled in Los Angeles by Mr. Crossman, that of branch manager.

—

ELECTIONS

CINCINNATI, Aug. 27—C. C. Chase, of the Eagle Cordage Mills, and J. T. Hatfield, of the Hatfield Coal Co., were elected to the board of directors of the United States Motor Truck Co. at the stockholders' meeting last week. A 7 per cent preferred stock dividend was declared and a substantial sum was set aside for new buildings and equipment. It is anticipated that the common stock will be placed upon a dividend basis at the next quarterly meeting.

—

NEW YORK, Aug. 27—Charles D. McCutcheon, who was formerly head of the Ross Automobile Co., is president of the Pathfinder Motor Co. of America, which has been capitalized in New Jersey for $2,000,000. The Pathfinder company will continue the present Pathfinder model and will also build trucks. Fred O. Dorn of Cleveland is vice-president, P. H. White of Indianapolis is secretary and treasurer, and C. Fairbanks, C. J. Root, A. C. Brown, W. A. Humphrey and G. H. Mesher are the directors.

—

NEW YORK, Aug. 23—The General Motors Corp. held its organization meeting in this city to-day and elected W. C. Durant president. Pierre S. du Pont was elected chairman of the board; T. S. Merrill, secretary; H. H. Rice, treasurer, and M. L. Prensky, controller.

The directors of the General Motors Corp. consist of the following, seven of the directors indicated being vice-presidents: A. G. Bishop, W. P. Chrysler, R. H. Collins, W. L. Day, C. S. Mott, E. Ver Linden and F. W. Warner, all vice-presidents; Pierre S. du Pont, W. C. Durant, J. A. Haskell, L. G. Kaufman, J. H. McClement and J. J. Raskob.

The finance committee is composed of

the following: Messrs. Kaufman, chairman; du Pont, Durant, McClement and Raskob.

The General Motors Corp. was formed last fall to succeed the General Motors Co. and issued four shares of 6 per cent preferred stock for every three shares of 7 per cent preferred stock of the former company, and five shares of common stock for every share of common stock of the former company. The corporation now owns all the common stock of the company, and the preferred stock of the company, practically all of which has been exchanged for General Motors Corp. preferred, has been retired.

After the meeting of the directors it was stated that for the fiscal year to end with the close of the current month the General Motors Corp. will show net income of approximately $30,000,000. This will be sufficient to pay the 6 per cent dividend on the preferred stock and leave a balance equal to about 35 per cent on the $82,600,000 outstanding common stock.

The sale of cars for the year will be approximately 185,000. Arrangements have been made for an output of nearly 250,000 cars in the coming fiscal year. The Buick company is now turning out 465 cars a day of the new model.

—

NEW YORK, Aug. 27—J. A. Campbell, president of the Coe-Stapley Mfg. Co., Bridgeport, Conn., has been elected chairman of the board of directors of the Smith Motor Truck Corp. He fills the vacancy created by E. I. Rosenfeld. C. E. Danforth of the firm of Van Emburgh & Atterbury, has also been elected to the board.

J. & W. Seligman and Van Emburgh & Atterbury of New York have acquired the control in the company of the interests formerly represented by E. I. Rosenfeld and his associates, who have severed their connection with the concern.

—

NEW YORK, Aug. 25—At a special meeting of the board of directors of the Adams-Williams Mfg. Corp., Francis C. Schwab was elected president. C. D. Williams was re-elected vice-president and L. W. Schwab was chosen secretary and treasurer. The company is manufacturing and marketing a line of convertible tops or glass inclosures for several well known makes of passenger motor vehicles.

—

BOSTON, MASS., Aug. 27 — Several changes have been made in the officers and directors of the Plymouth Rubber Co. as a result of the transfer of control of common stock. James J. Clifford is now president, Charles W. McDermott vice-president, J. E. Stone treasurer; the foregoing together with A. Sydeman, J. C. Haartz, W. G. Thomas and Marshal Cutting, directors.

—

NEW YORK, Aug. 23—R. B. Bursner, of Cleveland, has been elected a director of the American Motors Corp. Mr. Bursner is general manager of the Copen Creek Coal Co.

—

Poertner Drops Jeffery

NEW YORK, Aug. 27—Distribution of the Jeffery car in this city and surrounding territory, which has been in the hands of the Poertner Motor Car Co. for the past three years, has been taken over by the Nash-Warren Co., a wholesale branch. The Poertner company continues with the National.

Factory

Paige Motor Car Corp., Detroit, has taken a 10-year lease on the main building of the large bankrupt pickle plant. The annual rental is $25,000. The Paige company last week declared a 3 per cent monthly dividend.

—

Continental Motors Corp., Muskegon, Mich., has purchased a new site and will build a $200,000 plant on it.

—

Weston-Mott Co. is making axles for General Motors trucks for Government purposes.

—

Cadillac Auto Truck Co., Cadillac, Mich., is now erecting the second unit of its plant. The new section is 65 by 160 ft. and will be used as an assembly department.

—

Halladay Motor Car Co., Mansfield, Ohio, will move its plant to Warren, Ohio. The Warren Board of Trade has given the company 25 acres as a site and the automobile company will erect a building and will be in operation by Dec. 1.

—

C. R. Wilson Body Co., Bay City, Mich., is planning to erect an addition to its plant for the purpose of increasing its metal working department, at an expenditure of $175,000. The company will open its new plant in this city on Aug. 30. The main building is 300 by 300 ft., the dry storage building is 100 by 200 ft., the dry kilns are 50 by 200 ft., and the power house 50 by 91 ft.

—

Standard Aero Corp. has bought the John Stephenson Co. plant in Elizabeth, N. J., for $750,000 and is preparing to turn out sixty airplanes there each week. This will be one of the largest airplane plants where machines are entirely made under one roof. The Plainfield, N. J. plant for some time has been entirely inadequate. When the new plant is equipped there will be room for 6000 employees. There will be 86 acres of space, of which 20.8 contain the plant proper.

—

Dodge Bros., Detroit, have awarded a contract for a seven-story addition to their plant.

—

Biggam Trailer Corp. has purchased a plant at Corunna, Mich., with 80,000 sq. ft. of floor space, mill buildings, steam plants and electric light plants and will produce 200 heavy duty trailers per week including bodies. The main office of the company will also be located at Corunna.

—

Goodyear Tire & Rubber Co. is erecting a $1,500,000 plant in Toronto, Ont., to be completed about Sept. 1. It will employ 1500 men and women and have a daily output of 3000 tires.

—

Commercial Auto Body Co., St. Louis, Mo., has added 20,000 ft. of floor space to its factory by leasing a former garage building of the Entz Auto and Battery Co., at Nineteenth and Chestnut Streets. This will become the finishing paint shop. The company has two other factories where bodies are built and primed.

—

Madison-Kipp Lubricator Co., Madison, Wis., manufacturing mechanical and automatic lubricating devices for gasoline engines, machine-tools and other machinery, has completed a new three-story factory addition which will enable it to double its output. During the past year the company is reputed to have manufactured 60 per cent of all force-feed lubricating devices made in America, and the remaining 40 per cent were made by twenty competitive concerns. The company is now employing 250 men and is making units running from one to twenty-five for each machine. Last year's production of 500,000 units will be increased to approximately 1,000,000 during the coming year. Two-thirds of all tractors built in this country are equipped with Madison-Kipp lubricators, among the users being the J. I. Case, Advance-Rumely, International Harvester, Minneapolis Threshing Machine, Nichols & Shepard and Holt Mfg. companies.

—

C. A. Shaler Co., Waupun, Wis., maker of vulcanizers and tire repair aparatus, has purchased additional acreage and will erect a new warehouse and shipping room. This will release considerable space to the manufacturing departments. Next fall the company plans to erect several factory additions.

—

Moreland Motor Truck Co. has begun the erection of buildings to house the plant at its new home at Burbank, Cal. It is said the intention is not to abandon entirely the local plant but retain it almost intact for service and special body building.

—

Falls Motors Corp., Sheboygan Falls, Wis., has resumed operations after a

week's recess, during which inventory was taken and the entire plant overhauled for an indefinite run at full capacity. A new 40-in. smokestack, 80 ft. high, has been erected and the power plant generally improved. The company is employing more than 750 men on day and night shifts to fill orders for motor car, truck, tractor and airplane engines.

—

Wisconsin Welding & Cutting Co., Milwaukee, is extending its line of products to include seven mechanical devices for use in garages and repair shops. The line includes a "dollie" for loading and unloading chassis in box cars; a jack by means of which a car may be raised to the desired height by a single movement; interchangeable stands to be placed under the running board of a car that is being raised clear of the ground; a "dollie" for raising the rear end of Fords; a "dollie" for moving motors around a shop; a stand for overhauling Ford rear axles, and the Wisconsin Sky Hook, a portable hoist.

—

Keller Pneumatic Tool Co., Fond du Lac, Wis., is moving the equipment and machinery of its fixture department to Grand Haven, Mich., where a complete new plant has been erected for its purposes. The pneumatic tool department will be moved to Michigan later in the fall, but it is stated that some departments will remain in Fond du Lac permanently. The forces employed in the various departments will be transferred to Grand Haven as the machinery is moved and installed.

—

Heil Co., Milwaukee, operating a large tank and boiler works at Twenty-sixth and Montana Avenues, has started construction work on additions which will make it by far the largest manufacturer of motor dump-truck bodies in the world. The main addition will be a steel and brick shop, 130 by 200 ft., equipped with electric welding machinery, a 3-ton and a 5-ton electric crane, and cost about $100,000 complete. This shop will be devoted exclusively to the production of motor truck bodies by the electric welding process. The Heil Co. is handling large government contracts.

—

The Monarch Storage Battery Co. is moving from Detroit to Grand Rapids, Mich. T. H. Lavier is president.

—

Barley Motor Car Co., Kalamazoo, Mich., has contracted with the Limousine Top Co. for sedan bodies for the new model Roamers.

—

Edison Gives 10-Yr. Guarantee

ORANGE, Aug. 24—The Edison Storage Battery Co. has devised a 10-year guaranty for the Edison alkaline storage battery.

—

Calendar

ASSOCIATIONS

Oct. 9-11 — Pittsburgh National Assn. of Purchasing Agents, Convention.

CONTESTS

Sept. 1-2 — Detroit, Michigan State Fair, Track Racing and Aviation.
Sept. 3—Uniontown, Pa., Speedway Race.
Sept. 3—Cincinnati, O., Speedway Race, Championship.
Sept. 6—Red Bank, N. J., Track Race.
Sept. 8—Hillclimb, Pike's Peak, for stripped stock chassis.
Sept. 15 — Providence, R. I., Speedway Race.
Sept. 22—Allentown, Pa., Track Race.
Sept. 28—Trenton, N. J., Track Race.
Sept. 29—New York Speedway Race.
Oct. 6 — Danbury, Conn., Track Race.
Oct. 6—Uniontown, Pa., Speedway Race.
Oct. 13—Richmond, Va., Track Race.
Oct. 13 — Chicago Speedway Race.
Oct. 27—New York Speedway Race.
Oct. 24—Columbus, Ohio, Dixie Highway Tour.

SHOWS

Sept. 2-9—Spokane, Wash., Interstate Fair.
Sept. 3-7—Indianapolis, Indiana State Fair, Indianapolis Auto Trade Assn.
Sept. 9-15 — Milwaukee Show, State Park Fair, West Allis.
Sept. 9-15 — Milwaukee, Wis., Fall Show, Wisconsin.
Sept. 17-24 — Grand Rapids, Show, Automobile Business Assn.
State Fair, West Allis, Milwaukee Automobile Dealers.
Sept. 18-21 — Toronto, Annual Tractor Show, Canadian National Exhibition.
Sept. 18-22—Los Angeles, Cal., Second Annual Tractor Demonstration, Traction Engine and Implement Dealers' Assn. of Southern Cal.
Sept. 18-22—Reading, Pa., Automobile Show at Fair, Reading Automobile Dealers' Assn.
Oct. 1-6—Buffalo, N. Y., Closed Car Show, Automobile Dealers' Assn., Elmwood Music Hall.
Oct. 13-28—Dallas, Tex., Dallas Automobile & Accessory Dealers Assn. State Fair.
Nov. 12-18—Denver, Colo., Show, Auditorium, Automobile Trades Assn. of Colo.

1918

Jan. 5-12 — New York Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 19-26—New York, Motor Boat Show, Grand Central Palace, National Assn. of Engine and Boat Manufacturers.
Jan. 19-26—Montreal, Show, National Motor Show of Eastern Canada, Montreal Automobile Trade Assn.

Engineering

American Railway Master Mechanics' Assn.
American Institute of Electrical Engineers.
Master Builders' Assn.
American Society of Heating and Ventilating Engineers.
Association Iron and Steel Electrical Engineers.
Mining and Metallurgical Society of America.
Society of Automotive Engineers.
Illuminating Engineering Society.
National Electric Light Assn.
National Gas Engine Assn.
American Society for Testing Materials.
American Institute of Metals.
American Foundrymen's Assn.
Society Naval Architects and Marine Engineers.

SEPTEMBER

1—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
10-14—Assn. Iron & Steel Elec. Engrs. annual convention at Phila.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
15—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
17—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
20—Mining & Met. Soc. of Amer. monthly meeting N. Y. section at Engrs. Club.
24—Amer. Inst. Metals at Boston.
24—Amer. Fdry. Assn. annual meeting at Boston.

OCTOBER

6—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
13—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
15—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
17-18-19—Amer. Gas Inst. at Washington, D. C.
18—Mining & Met. Soc. Amer. monthly meeting New York section Engrs. Club.
20—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.

NOVEMBER

3—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
10—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
15—Mining & Met. Soc. Amer. monthly meeting New York section at Engrs. Club.
15-16—Soc. Naval Arch. & Marine Engrs. annual meeting.
17—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
19—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.

DECEMBER

1—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
15—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
17—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
20—Mining & Met. Soc. Amer. monthly meeting New York section at Engrs. Club.